AD 661001

ONR-26

Department of Defense

THE MAKING OF TEST

THESAURUS OF ENGINEERING AND SCIENTIFIC TERMS

FINAL REPORT
OF
PROJECT LEX

Office of Naval Research

November 1967

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THE MAKING OF TEST

Thesaurus of Engineering and Scientific Terms

Final Report
of
Project LEX
A Task Force For The Preparation Of A
Department of Defense Technical Thesaurus

Standardization Project No. MISC-0359

By
J. Heston Heald
Office of Naval Research

1967

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"Think like a wise man
but communicate in the
language of the people"

- - William Butler Yeats

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I.

INTRODUCTION

The primary objective of Project LEX was to prepare a DoD-wide scientific and technical thesaurus. The Project officially began operations on 13 December 1965, and although its work was essentially completed on 31 May 1967, a small element remained activated to monitor the printing and primary distribution and to prepare this report as well as to handle termination matters. The reasons for a DoD-wide thesaurus, the establishment of Project LEX, its organization, management, philosphy, and operational procedures, its joining hands with Engineers Joint Council and the resultant publication of the Thesaurus of Engineering and Scientific Terms are discussed along with some describing statistics. Appended to this report are documents which provide immediate reference and are pertinent as matters of the final record.

The author gratefully acknowledges the assistance of Mrs. M. Louise Fleming in compiling much of the material and preparing the report for publication. Also acknowledged is the contribution of Mr. David S. Weaver, Engineers Joint Council, who prepared the detailed printing specifications from which the programs for computer controlled typesetting were prepared. These appear in Appendix 8.

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II.

THE CONTEMPORARY THESAURUS

In recent years a large number of contemporary thesauri have appeared. Their appearance has been concurrent with moves toward automation of information storage and retrieval systems and born out of a realization that if humans are to make use of the many increased possibilities of machines in the information business they must also discipline themselves to some degree in the manner of usage. This is somewhat contrary to the often heard comments that the machine should be the complete slave, developed in such a manner that the long established customs and even tenor of humans can continue unchanged. Such is not quite the case. Whether admitted or not, to apply mechanized techniques effectively to library type functions and the transfer of information, human beings must make certain changes and perhaps forego certain freedoms with which they have long been accustomed. It could be that this effect is only tentative, but it seems to be a bridge that must be crossed in the evolution toward advanced systems in the automation state-of-the-art. The thesaurus approach to the dealing with subject matter and the subtlties of normal language attempts to ease this transistion by providing a degree of control over previously established terminology and at the same time leaving itself admissible to change and growth. Hence it may be thought of as a close relative of both classification and subject heading systems as well as to unit-concept principles.

Perhaps the prominent difference between the present thesaurus pattern and other styles of term or word listings is in its heavier emphasis on uniqueness of terms. This factor is highlighted in increased efforts to reduce ambiguity in the overlapping of meanings and to clarify the use of synonyms and homographs.

The general objective, then, has been to arrange the main thesaurus terms in such a way that they represent single concepts and then to form a guide or road map for the user through a system of generic displays, cross references, and indexes. These processes and how they have been treated by Project LEX will be dealt with in the paragraphs which follow.

III.

THE NEED FOR AN INTERDISCIPLINARY THESAURUS

In 1958 the former Armed Services Technical Information Agency (ASTIA) - now the Defense Documentation Center (DDC) - took steps to convert its major operations from manual to automated systems. At that time there was little precedent for the move and most of the mechanical techniques for library-type functions were yet to come. In adjusting to computer operations for information storage and retrieval ASTIA made numerous studies of its own experiences, as well as those of others, and determined that a need existed for a controlled thesaurus-like vocabulary for subject matter indexing and searching functions. Hence, in 1960 the Thesaurus of ASTIA Descriptors appeared and 180,000 technical reports representing receipts back to 1953, were re-indexed accordingly.

At about the same time the American Institute of Chemical Engineers (AIChE) began work on a thesaurus and in 1961 published the Chemical Engineering Thesaurus. It is interesting to note that although neither ASTIA nor AIChE knew of each others effort until close to publication, the pattern followed by both was quite similar.

Based on two years of application ASTIA revised its Thesaurus and published a second edition. Then in 1964 the Engineers Joint Council (EJC) published the Thesaurus of Engineering Terms which broadened the base of AIChE's lead to include essentially all engineering disciplines.

These were some of the early large contemporary thesaurus ventures. By 1964, thesauri were cropping up on many fronts - especially in the fields of scientific research and development. There were several within activities of the Department of Defense other than DDC. Microthesauri, specific expansions in narrow subject fields, were becoming prevalent. The problem was that there was no authoritative guide or convention to follow. Each activity devised its own format and established terms under interpretations or meanings that often differed with others. No two thesauri were built the same way and this fact alone created communication barriers that inhibited development and use of information network systems. An important point was that the general objective was the same in most instances; a language control through thesaurus-like arrangement. The need for uniformity, both in thesaurus format and in treatment of terms became sharply apparent by 1964.

During 1964, the Committee on Scientific and Technical Information (COSATI), recognizing the need for government-wide

guidance, developed and adopted the COSATI Subject Category List* (SCL). COSATI is one of the committees under the Federal Council for Science and Technology. SCL was developed by a sub-panel headed by Mr. Paul Janaske of the Clearinghouse for Federal Scientific and Technical Information (CFSTI) and made up of representatives from the several government agencies having research and development interests. SCL appeared in December 1964. Admittedly, it represented only an initial effort - but it did provide a start toward standardization on a government-wide basis. Revision and improvement in the List was expected. But these steps could not be profitably undertaken without experience gained from actual implementation.

The SCL was purposely made on a very broad subject scale. Twenty-two major scientific and technical "fields" were subdivided into 178 "groups." Although SCL provided an immediate tool for certain management and announcement uses, the fields and groups were far too broad for document indexing and retrieval. Nevertheless, it did provide a base upon which any activity could build a more specific terminology.

*Available as AD 612 200 from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

IV.

THE ESTABLISHMENT OF PROJECT LEX

With all of the above points in mind Mr. Walter M. Carlson, then the Defense Departments' Director of Scientific Information, decided to move forward with the development of an authoritative DoD-wide technical thesaurus along with rules and conventions for thesaurus building. The COSATI SCL was to be used for a base as far as it proved to be feasible. The Office of Naval Research was selected to perform the task and implementation took place in a multiple-address memorandum from the Director, Defense Research and Engineering to the Secretaries of the Army, Navy, and Air Force, and to pertinent Directors of Defense Agencies and Assistant Secretaries of Defense. The 10-page memorandum was signed by Dr. John S. Foster, Jr., and dated October 12, 1965. The complete memorandum appears in this report as Appendix 1. Also included in Appendix 1 are two supporting papers, one from OSD, Comptroller, designating the Project as the Assigned Responsible Agent for Standard Data Elements in the scientific and technical field. The second from OSD (I&L), established the Project as Standardization Project Number MISC-0359. Thus Project LEX began.

The Foster Memorandum set forth the mission of Project LEX, although it did not provide the name. Briefly, the mission called for the compilation of a comprehensive interdisciplinary reference authority for the terminology used in describing the scientific and technical subject matter associated with such Department of Defense activities as requirement studies, intelligence estimates, program planning, budget analysis, research and development, operations, supply maintenance, and data element standardization.

Three products were called for:

1. A manual setting forth DoD conventions for thesaurus building.

2. A thesaurus of scientific and technical descriptors.

3. Recommendations for any changes to the COSATI Subject Category List that might become apparent during the course of the work.

The name "LEX" was chosen for the following reasons:

1. The letters form the first syllable of the word "lexicon" and a thesaurus is a kind of lexicon.

2. The word "lex" means law or authority. This was suggested by the authoritative nature of the end product, as indicated in the mission statement above.

3. Another connotation, "in full", is suggested by the broad coverage.

The adoption of this name proved to be exceedingly helpful during the course of the work. It soon became identified with the Project and assisted in communications, alignment of panel participants, procurement of supplies and terminology, and even in computer support work. It was an easy code as well as a name. Since evidently it had never been used, it caught on quickly as a simple unique reference to the whole effort.

Although the Foster Memorandum provided considerable guidance for Project LEX, the Office of Naval Research was given wide flexibility for operational and organizational procedures. All pertinent elements in DoD were enjoined to cooperate in the venture and to suspend further thesaurus building efforts in favor of concentrating resources into the DoD-wide task. The Memorandum provided for assignment of focal point representatives to the Project from Army, Navy, Air Force, Defense Documentation Center, DIA, and NSA. Optional assignments of focal points for other elements was also authorized. Those who were assigned as focal points and their mission statement as issued by the Director of Technical Information are attached as Appendix 2. Direct communication channels between the Project and the various pertinent DoD elements was exercised throughout.

The author of this report was named Project Director and transferred to ONR from the Office, Director of Technical Information where he had served as staff assistant.

The Project was seated under the Research Coordinator in ONR. In the beginning this position was held by Dr. Matthew H. Schrenk who also doubled as the Navy's Focal Point Member to the Director of Technical Information. After Dr. Schrenk's retirement in December 1965, Mr. Robert J. Mindak in the ONR Office of Technical Support served as Project Officer.

Approximately 2,500 square feet of office space was obtained for the Project in Building Tempo "E" at 4th and Adams Drive, Southwest, Washington, D. C. This provided ample space for 12 to 14 full time staff members, a conference room, and a large working area for working panel sessions, and working materials. In addition

to the normal office equipment, large conference tables were procured for working groups. A Xerox 914 was provided and was steadily used for small reproduction jobs. A 3M Filmac 400 (Microfilm reader-printer) was installed to afford rapid access to all information in the data bank (discussed further under the section on Acquisitions).

Every effort was made to bring the best available lexicography know-how to bear on the Project as well as scientific and technical expertise. In general, this was done in three ways:

1. A full-time staff of technical and experienced lexicographers was either employed by the Project or detailed to it from activities outside ONR.

2. By contract arrangements for computer support, panel leadership, and terminology input.

3. By a series of subject panel sessions to which specialists in major subject fields were invited to participate.

The Foster Memorandum provided the mechanism for assembling the staff. (See Enclosure 2 to Appendix 1). Selection and arrangements were left to the Director and the DoD elements involved. This required a number of varying arrangements since each situation seemed unique. Nevertheless, a high degree of success was experienced in obtaining well qualified individuals for full-time operations. Both lexicography and scientific backgrounds were the desirable combined qualifications. It is believed important for this record to list their names as well as those who provided administrative and clerical assistance. They are shown below along with the approximate number of weeks each served plus their "home" activities and other related connections:

Name	No. of Weeks on LEX	Activity/Connections
J. Heston Heald	78	Director, Project LEX Office of Naval Research
Wallace D. Barlow	24	Lexicographer Naval Material Command
Kenneth E. Breisch	78	Lexicographer Office of Naval Research

John A. Dovel, Jr.	62	Lexicographer System Development Corporation FTD, DIA
Alma S. Evans	57	Lexicographer Department of Defense
Terry L. Gillum	78	Lexicographer Defense Documentation Center COSATI, EJC, OE
Margaret S. Hicks	77	Lexicographer Clearinghouse for Federal Scientific and Technical Information COSATI, EJC
Jane V. Philbrick	30	Lexicographer Defense Documentation Center
Dr. Matthew Schrenk	2	Consultant and Senior Advisor Office of Naval Research
Ruth Camp Smith	78	Lexicographer Naval Ship Research and Development Center NARDIS, EJC
Grace Swift	72	Lexicographer Department of Defense
- - - - - - - - - -		
Illana D. Banks	75	Clerical Assistant Office of Naval Research
Cynthia A. Burns	74	Secretary Office of Naval Research
M. Louise Fleming	78	Administrative Assistant Office of Naval Research
William S. Mensh	13	Clerical Assistant Office of Naval Research
Total man-weeks	876	

Key to Abbreviations:

COSATI - Committee on Scientific and Technical Information, Federal Council for Science and Technology
DIA - Defense Intelligence Agency
EJC - Engineers Joint Council
FTD - Foreign Technology Division, Air Force
NARDIS - Navy Automated Research and Development Information System, Naval Ship Research and Development Center
OE - Office of Education, Department of Health, Education, and Welfare

ONR Contract N00014-C0180 was awarded the ARIES Corporation, McLean, Virginia to provide automatic data processing support to the Project. Three supplements were provided the original contract as increasing amounts of terminology were received and requirements added. Overall, the contractor placed the selected input data on magnetic tape, merged this data into preliminary thesaurus arrangement to form the data bank, provided special printouts in the major subject fields for review and development of the final work, keyboarded and placed on magnetic tape all terms that were established, verified spelling, arranged the whole in a system of letter-by-letter sequencing, checked for completeness of reciprocals, cross-references, and generated cross-references where necessary, provided printouts for final manual editorial review, prepared the indexes, and finally prepared the insert programs and magnetic tapes for electronic controlled typesetting for printing the Thesaurus. These functions will be discussed further in other paragraphs.

The last method of procuring assistance was through a series of working panel sessions. These are shown in Appendix 3 and discussed in detail later under the heading Working Panel Sessions.

V.

JOINT ARRANGEMENTS WITH EJC

Project LEX opened its offices in Tempo "E" Building on 13 December 1965. A short time prior to that, Engineers Joint Council with headquarters in the United Engineering Center, New York City, began the task of revising the first edition of the Thesaurus of Engineering Terms (1964). Realizing that the two efforts would move forward at essentially the same time and would cover much of the same subject matter, the Director of Project LEX and the Director, Information Services, EJC, Mr. Frank Y. Speight, met and discussed possible points of cooperation. A number of meetings and communications followed. Gradually, what started out as partially unified operations soon matured into a full-fledged joint project.

No transfer of funds was involved either way. Contributions from both sides could hardly be evaluated in dollar and cents. The potential pay-off of a single thesaurus to serve both the Department of Defense and the engineering community far overshadowed any monetary differences that might exist in the contribution from one or the other. The investments of each in the other were already great; multi-billion dollar interests were represented. Improved communications and interchange of engineering and scientific information that stood to result through a common vocabulary were the compensating factors.

The principle documents that formed the joint agreements are included in Appendix 4. It turned out that there was very little precedent for joint government-industry publications of this kind and some very interesting problems arose in this connection. Most of them turned out to be of minor nature; however, the problem of proprietary rights and copyrights were not so simple. These are discussed here only briefly.

EJC had received some government subsidy (National Science Foundation) in preparing the Thesaurus of Engineering Terms (1964). Sales of this publication had been quite successful and it could be foreseen that updated and improved revisions from time to time might well be self-sustaining. This was the basis on which EJC started the second edition. In joining hands with Project LEX it became apparent that sales by EJC might so be weakened by the normal government sales and broad internal distribution as to jeopardize the self-sustaining aspects of their program. This was resolved in the decision to give EJC sole rights for sale.

The copyright problem was closely related to the sale problem. Copyright cannot subsist in government publications. The government

may however, recognize the use of copyrighted material in government publications. EJC granted to Project LEX the right to use any or all of the first edition of Thesaurus of Engineering Terms, which was copyrighted. Hence, the statement was agreed upon which appears in the letter of January 12, 1967, (Appendix 4) from the Chief of Naval Research to the Executive Director, EJC. It merely informs holders of the copies prepared for government use that copyrighted material is included and that its use in the non-copyrighted issue does not annul such copyright. EJC could copyright the issue it prepares for sale to the public provided it recognized full freedom of use by the government. With these agreements reached, the Project became truly a joint one and moved toward publication of a Thesaurus that would have identical content for both government and non-government users.

The principal trade-off factor of the LEX-EJC agreements was that EJC would initially provide some 20,000 computer prepared term work cards (8" x 14") from its computer merge of 65 source vocabularies. Project LEX would then provide the computer processing required for the remaining work and for the final thesaurus plus camera-ready copy with a final magnetic tape in linear format. There were many other tradeoffs as the work progressed but they were generally the types that happen routinely in a cooperative effort, and, as indicated earlier it was felt that any imbalance would be offset by end product effectiveness. Hence, as the procedures of Project LEX are discussed in these pages they should be thought of as jointly involving the efforts of DoD and EJC whether or not such fact is stated.

VI.

ADMINISTRATION

Figure 1 shows a schematic arrangement of the major events. Each of them may be considered as having many minor events not shown here. Much of the work performed at each point is discussed under appropriate paragraphs.

The timetable shown in the Foster Memorandum (Appendix 1) provided a schedule guide. As anticipated this schedule proved to be very tight and by the end of actual operations at the Project an approximate ten-week slippage had accumulated. This was largely due to an input of terminology that amounted to almost twice the anticipated amount. However, the slippage in time and the additional terminology input did not result in a requirement for additional resources, manpower or dollars. In fact, in both instances the Project ended with a small plus. Reducing the man-years to man-weeks is necessary to show the difference in established manpower and used manpower. The Foster Memorandum established a requirement of 910 man-weeks (17½ man-years) of civil service employee time from the assigned staff. The Project used 876 man-weeks.

The following is the financial breakdown, only in broad categories:

Original funds made available for entire task -	$448,000
Expenditures	
Personal Services	116,761
Printing	22,500
Contracts	278,725
Administrative Support	20,400
Total -	$438,386*

*This figure includes an estimated cost of minor phase-out expenses.

The Project divided its work into five operational phases. They were, in the order in which they occured:

1. Acquisitions

2. Conventions

MAJOR EVENTS

PROJECT LEX
SCHEMATIC ARRANGEMENT

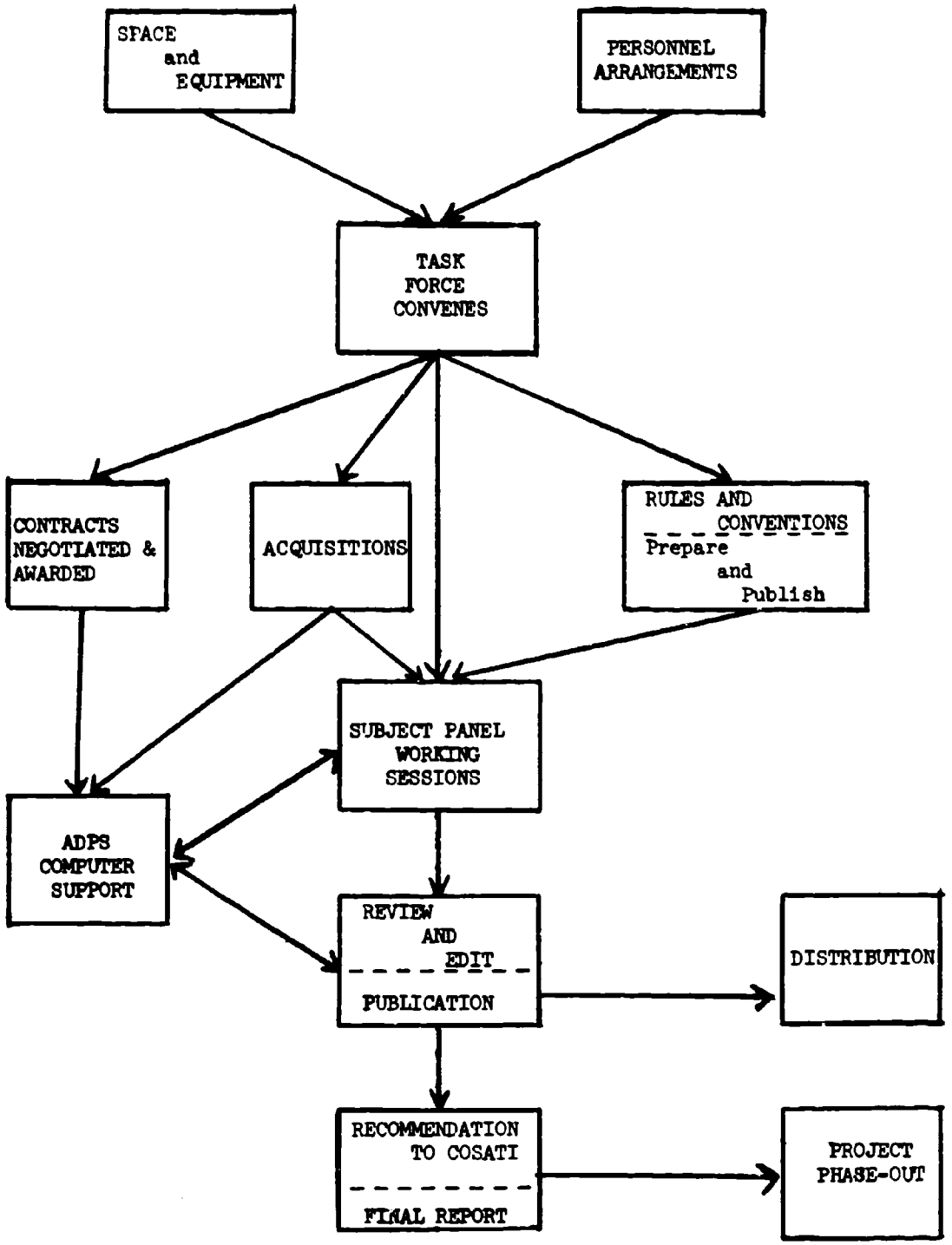

Figure 1

3. Working Panel Sessions

4. Edit and Review

5. Publication

Each of these phases will be discussed separately in following sections. Actually, the first four phases represented the heart of Project LEX, per se, and were essentially completed by 31 May 1967. The fifth phase was performed by GPO although Project LEX continued as the cognizant office through this phase with only two members of the staff remaining. During that time the recommendation to COSATI regarding its Subject Category List was prepared, Appendix 5, this report was prepared, the move of the continuing effort to DDC was made, and other routine phase-out operations completed.

VII.

ACQUISITIONS

After the Project was located in its working area and the staff assembled, the first order of business was the acquisitioning of pertinent (1) reference aids, and (2) candidate terminology. Appendix 6 lists the results of this effort. Both categories are interfiled alphabetically by source in the Appendix. The asterisked items are those which were selected and merged by computer to form the data bank, discussed later. All of these fall in the second category.

The reference aids were composed of scientific and engineering dictionaries, encyclopedias, glossaries, data and handbooks, technical spellers, catalogs, and standard military usage authoritative lists and definitions. Many of these were purchased, especially commercial publications, others were provided on loan, while still others were given to the Project upon request.

The second category, candidate terminology, served as the direct raw product - the working material from whence the final terms and concepts chosen for TEST came. These were lexicons of various types - thesauri, glossaries, dictionaries, subject heading lists, and various other types of word lists. Almost all of these were furnished upon request. They totaled 330 items and in all contained over 400,000 terms. Of course, many of these terms were duplicates. A careful selection of these lexicons was then made for the data bank. The rest were placed among the reference aids where they could be used for manual reference at any time. The total candidate vocabulary represented a massive collection of terms and data concerning them.

The data bank was formed by merging the 145 selected vocabularies. The main criteria for selection were:

1. They contained scientific and technical terminology.

2. Their development was from the actual indexing experiences, thereby representative of storage and retrieval requirements.

3. They were strong in thesaurus-like arrangement showing various kinds of cross-referencing data, generic relationships, scope notes, and frequencies of use.

This collection came to Project LEX in many forms and formats. In fact, no two were exactly alike. Many different methods had been used in their arrangements. Different terms were often used for the same concept and vica-versa. These factors emphasized the built-in communication barriers created by dissimilar arrangement and treatment of terms. The merge was an ominous task indeed. Manually it would have been almost insurmountable. The computer provided the best possible way to do the job, at least to reduce the task to the point where manual treatment could have a reasonably sound place to take over.

The computer could recognize similar, as well as dissimilar, word or term forms, but it could not recognize similar or dissimilar concepts. Here manual treatment would have to enter the picture. Hence, a merge of all similar terms was made by computer so that the term appeared only once. Under each term was the accumulated data that had been provided by any or all of the submitting sources. The result was about 145,000 separate terms and 1½ million line items of data. The whole data bank file required 8 magnetic tapes and 900 feet of 16 millimeter microfilm. This file comprised the working data bank of the prime candidate terminology.

EJC provided the initial computer input to the data bank through a contract with Westinghouse Corporation, Pittsburgh, Pennsylvania. Dr. Paul Henderson was in charge of this work. Sixty-five of the source vocabularies were merged by Westinghouse and the data placed on large work cards. At least one 8" x 14" card was prepared for each term. In some cases, additional cards were necessary to hold the data for a single term. This collection totaled about 20,000 cards. The cards provided sufficient space for manually recording decisions as work progressed. Blank cards were procured for use as additional terms were considered from time to time.

An additional 80 source vocabularies were then merged and added to the Westinghouse file under an ONR contract with ARIES Corporation, McLean, Virginia, to form the complete 145 vocabularies in the data bank. Mr. William Hammond was in charge of all computer work at ARIES and this contract provided all ADPS support after the initial work at Westinghouse.

After the data bank was placed on magnetic tape a visible access to the information was created by direct conversion from magnetic tape to 16 millimeter microfilm. Nine 100-foot cartridges were prepared for use on a Filmac 400 Reader-Printer which was installed in the working area. This automatic access microfilm made it possible to find any term in only a matter of moments. The information could then be seen on a visible screen or a print could

be made in 6 seconds for desk copy reference. A typical printout from the data bank for a single term, Information Retrieval, is shown in Figure 2. With the exception of the notation symbols, the two-letter codes indicate the sources of the term. On the right hand margin the sources are shown opposite the treatment each had given to the term. The notations were either picked up or generated by the computer to conform with LEX conventions.

This example shows that the term appeared in 23 of the source vocabularies. (The key to all sources may be found among the asterisked items in Appendix 6.) The numerical digits following the source codes show the field (first two digits) and groups (last two digits) of the COSATI Subject Category List whenever such indications had been given either by the sources or by the computer from related usage information. Some interesting points should be mentioned here.

1. The scope note (SNO-1-2-3-4-5) used by the DD (Defense Documentation Center) eliminates use of the term for manual techniques, while HI (Highway Research Institute) uses the term for library searches without limitation.

2. DD FRQ 990. Indicates that as of the time the data bank was compiled, DD had used the term (frequency) 990 times.

3. AV (Army Research Office) used Data Processing as a broader term while SP (Society of Photographic Sciences and Engineering) used Data Processing in the opposite sense as a narrower term.

4. DD and WR (Water Resources Research Office) agreed that Documentation was a broader term while EJ (First EJC Thesaurus of Engineering Terms) used Documentation only as a related term.

5. BY (The Boeing Company) used Information Retrieval as a USE reference, referring the user to Information Storage and Retrieval, MZ (National Library of Medicine - MEDLARS) shows the opposite treatment by showing Information Retrieval to be used for (UF) Information Storage and Retrieval.

These were the kinds of information and data which the acquisition programs brought to bear upon the Project. They presented the problems and at the same time presented information that was useful in solving the problem.

INFORMATION RETRIEVAL

WR0800	LB05	AV	AZ	BY	AR15	DD0502
BR	EJ	CM	HI	EI	LM1506	FC
MS	IE	MR11	MZ05	NA0010	NE	NO
SP	VO					

DD SNO THE USE OF COMPUTERS, ELECTRONIC ACCOUNTING MACHINES, AND SIMILAR MECHANICAL DEVICES TO ORGANIZE STORE AND RETRIEVE RECORDED INFORMATION. FOR THE USE OF MANUAL TECHNIQUES IN SUCH ACTIVITIES SEE (DOCUMENTATION).
DD FRP 990

USE	INFORMATION STORAGE AND RETRIEVAL	BY
UF		
	DOCUMENT RETRIEVAL	EI
	INFORMATION STORAGE AND RETRIEVAL	MZ
	LIBRARY SEARCHES	HI
	RECORDS RETRIEVAL	EJ
	RECORDS RETRIEVAL	HI
BT	DATA PROCESSING	AV
	DOCUMENTATION	DD
	DOCUMENTATION	WR
NT	COMPUTERIZED INFORMATION RETRIEVAL	AV
	DATA BANK	AV
	DATA PROCESSING	SP
	DATA RECORDING	SP
	DATA RETRIEVAL	WH
	DATA STORAGE	SP
	DOCUMENT RETRIEVAL	WH
	ENVIRONMENTAL INFORMATION RETRIEVAL	AV
	INFORMATION DISSEMINATION	AV
	INFORMATION STORAGE	AV
	SEARCH STRUCTURING	WH
	STINFOR	AV
	VOCABULARY DEVELOPMENT	AV
RT	BIBLIOGRAPHIES	WR
	COMPUTERS	BS
	DATA COLLECTIONS	WR
	DATA RETRIEVAL	EJ
	DOCUMENTATION	EJ
	ELECTRONIC ACCOUNTING MACHINES	BS
	FILING SYSTEMS	EJ
	IMAGE STORAGE	SP
	INDEX TERMS	EJ
	INDEXES (LOCATORS)	EJ

(Cont'd next page)

Figure 2

LIBRARY SCIENCES	EJ
MACHINE TRANSLATION	BS
MICROFILM	EJ
MICROFILM SELECTORS	EJ
PUBLICATIONS	WR
RECORDS MANAGEMENT	EJ
RECORDS STORAGE	EJ
SEARCH QUESTIONS	EI
SELECTIVE DISSEMINATION	EI
TRANSLATIONS	WR
INDEXING VOCABULARY	WH

Key to Abbreviations:

AR - Air Force Avionics Laboratory, WPat AFB, Ohio
AV - Army Research Office, Washington, D. C.
AZ - National Center for Atmospheric Research, Boulder, Colo.
BR - Bureau of Reclamation
BY - Boeing Company, Seattle, Aerospace Group
CM - Engineering Manpower Commission, New York, N. Y.
DD - Defense Documentation Center, Alexandria, Va.
EI - Engineering Index, New York, N. Y.
EJ - Engineers Joint Council, New York, N. Y.
FC - Federal Council of Science and Technology, Committee on Scientific and Technical Information
HI - Highway Research Institute
IE - American Institute of Industrial Engineers, New York, N. Y.
LB - Lea Bohnert Documentary Vocabulary
LM - Army Logistic Management Center, Ft. Lee, Va.
MR - Army Materials Research Agency, Watertown, Mass.
MS - Miscellaneous
MZ - Medical Literature Analysis and Retrieval System
NA - National Aeronautics and Space Administration
NE - Navy Electronics Laboratory
NO - Naval Ordnance Laboratory
SP - Society of Photographic Scientists and Engineers
VO - Aktiebolaget Volvo, Goteborg, Sweden
WR - Office of Water Resources Research

VIII.

CONVENTIONS

Appendix 7, Thesaurus Rules and Conventions, henceforth referred to as Conventions, was developed and established jointly with Engineers Joint Council. These were the "rules of the road" in building TEST. Appendix 7 is actually the final version as published by EJC in its Guidelines for Indexing and Abstracting. An earlier version was prepared by Project LEX and included in the DoD Manual for Building a Technical Thesaurus, ONR-25, AD 633 279, April 1966. Both are in agreement in all respects.

Development of the conventions was the second major task of Project LEX and, of course, had to precede the actual work on TEST. It was desirable that the conventions be drafted by experienced individuals representing a broad base of activities in thesaurus and lexicography work. Hence, 32 people, representing 23 different activities participated, at one time or another, in the deliberations which led to these conventions. Their names are listed in the DoD Manual referred to above. The later EJC version, shown in the Appendix, primarily represented a careful editorial and clarification rewrite.

Although the Conventions appear in Appendix 7, it is felt desirable to address some comments to the important features and the philosphy behind them.

As might be expected, when the conventions were being drafted, there was not complete agreement on all points, but acceptable decisions were reached in the few controversial areas through deliberations and some compromise.

Probably the most difficult issue to settle was that of sequencing. What form of alphabetization should be used? The first draft called for word-by-word alphabetization. Variations of this system are more prevalent in library catalogs and computer programs, however, a letter-by-letter arrangement is usually followed in dictionaries and encyclopedias. Considerable discussion and study was given to the pros and cons for both systems.

The second and third drafts of the conventions changed the sequencing rule to a form of letter-by-letter collation. About 800 copies of the third draft were circulated for comment and in final deliberations by the committee, the letter-by-letter rule was adopted.

By this time a large share of the acquisition program had been completed and most of the data bank vocabularies had been merged on magnetic tape. This first merge followed the routine computer sort program - a form of word-by-word arrangement. Questions that may have still lingered in the minds of the staff as to which was the better method diminished as use of this first merge began.

Different word or term forms often created considerable separation of locations. For example, Electrooptics, Electro-optics, and Electro optics were all submitted by source vocabularies used to make up the data bank. Several pages of terms and data separated each of the word forms. This, of course, tended to defeat the purpose of the merge. More important, if TEST followed a word-by-word collation, a user approach by either of the unselected terms might not be successful. A system of cross-references to preferred forms, as well as preferred terms, would then be necessary. It was largely this kind of problem that led to finally adopting the letter-by-letter sequencing convention. Then no matter what form the user chose or what form was selected by the Project, the location would be the same. A re-run of the data bank, collating it letter-by-letter, proved this decision to be wise.

Another matter of concern to the makers of the conventions was that of word order within a multi-word term. Some guidance was provided here by the Foster Memorandum which specified the use of - - - "natural language that will afford rapid and straightforward approaches - - -". This had an influence on the adoption of Rule T-4 which provided that terms with one or more words use a direct rather than indirect word order, e.g., Radar antennas rather than Antennas, radar.

This rule proved easier "to say than to do." It was somewhat compromised by Rule T-5b which permitted the use of a parenthetical expression after a word - as a part of the term - to clarify the meaning such as in Mercury (metal) and Mercury (planet). While this appears to be something of a compromise, closer inspection shows that the direct form in these cases, with or without parenthesis would be slightly unnatural. Furthermore, the parenthetical words indicate different subject areas or fields to which the homograph applies. It was largely to this concept that Project LEX restricted the use of the parenthetical expression.

In other deliberations on T-4, it became obvious that a natural order of words to one person might not be the same to another; depending on where the emphasis is given. This was espec-

true with terms having more than two words. Nuclear binding energy vs Binding nuclear energy; Nitrogen organic compounds vs Organic nitrogen compounds; etc. If one adds to this the additional possibilities of indirect forms, there could be six possible arrangements for either of the above terms with which a user might approach the Thesaurus. Hence, although the direct natural entry did not resolve all approaches, it did reduce the possibilities of the user being misguided. The decision to use the Permuted Index, discussed later, was largely based on these factors. Additional cross reference to provide for all possible approaches would not have been tolerable.

The system of cross references as set forth in Rule C-1 through C-8 are the foremost brands of the contemporary thesaurus. The "use" (USE), "Used For" (UF), "Broader Term"(BT), "Narrower Term" (NT), and "Related Term" (RT) have sometimes been likened to the traditional library notations for subject headings. One such comparison follows:

USE = See
UF = Refer from (x)
BT = Refer from (x)
NT = See also (sa)
RT = See also (sa)

Only in the first instance is there a one-to-one comparison. "Refer from" and "See also" have dual roles. The Thesaurus notations are more explicit and succinct. Whole hierarchical relationships are expressed in the BT$\longleftrightarrow$NT reciprocating treatment, while part-whole relationships are shown as RT's. For example, the term Typewriters is shown as a broader term than Automatic Typewriters since there is a whole relationship. An automatic typewriter is a kind of typewriter and the BT$\longleftrightarrow$NT family relationship exists. However, the term Keyboards, represents a part, not a kind of typewriter, and has a part-whole relationship. It then, is given the RT$\longleftrightarrow$RT cross reference with Typewriters.

The Conventions provide for use of the name "descriptor" for the preferred term. A USE reference is not to be used as a term for indexing or searching, but refers the indexer or searcher to the preferred term or descriptor. Of course, where computers are used this referral can be automatic. Multiple USE references are also provided for in Rule C-3, although used rather sparingly in TEST. An example is Automatic transmission fluids. The descriptors Automatic transmissions and Transmission fluids are both to be used in coordination by the indexer and by the searcher where the subject of automatic transmission fluids is treated. This treatment increases the chances of retrieval relevance for a specific area.

All-in-all the above notation system adds at least three assets to the more conventional devices of lexicon arrangement.

1. An improved hierarchical display.

2. Increased clarity of meaning, thus having the effect of improving the uniqueness of the terms.

3. Assists other factors in providing a road map to the desired or proper term.

Note: As this report was being written, COSATI adopted and prepared for publication, Guidelines for the Development of Information Retrieval Thesauri. This provides government-wide guidance for the preparation of technical thesauri. It is gratifying to note that the Conventions recorded here are compatible with the COSATI Guidelines.

IX.

WORKING PANEL SESSIONS

Early in the planning of Project LEX it was decided than an effort would be made to solicit professional assistance through a series of working panel sessions in the major subject fields. Preparations for the sessions began while the acquisitions and conventions phases were in progress. In April 1966, four months after the Project started, the conventions had been framed, the major acquisitions were completed, the data bank compiled, and the panel sessions started. There were 21 separate sessions and each of these were divided into smaller groups. The COSATI Subject Category List was used as a guide, although not followed explicitly, in determining the subject fields to be covered at each session.

By the time the sessions started, EJC and Project LEX had drawn closely together. In doing so, a decided advantage was gained by both. Most of the subject areas were common to both. Participants for one were thus participants for the other. Each session served dual purposes and by working together in the dual roles, complete compatibility of the terminology and its treatment was the result. Since the participants time was volunteered, utmost advantage was made of each contribution. All sessions were held in identical working areas although a few were held under primary cognizance of LEX or EJC depending on the emphasis of the subject. This breakdown is reflected in the schedule.

Many steps were taken to broadcast this schedule of sessions to scientists, engineers, and subject information specialists and specialized librarians. Engineers Joint Council requested and received help from its member societies. The National Security Industrial Association (NSIA) took an active part in providing assistance to almost every session from its industrial membership. The Special Libraries Association (SLA) and the American Documentation Institution (ADI) published articles announcing the sessions. Also, the DoD offices made appeals for participation and otherwise publicized the Project in various media. Prominent among these were the NRL Labstracts, Defense Documentation Center Digest, Navy's Scientific and Technical Information Program Newsletter, Office of Naval Research Originator, Army's Army Research and Development news magazine, Air Force's STINFO Newsletter, and Armed Forces Management. The Project Director and the Director of Information Services, EJC, made numerous appearances before professional groups accross the country to increase interest and gain additional panel session support.

The result was that 329 individual scientists, engineers, and information specialists participated an average of five days each

in the sessions. It was here that the hard core of the final vocabulary was established. Mr. Eugene Wall, LEX-Inc., was engaged, through the ARIES contract to lead the sessions. Mr. Wall had prominently figured in several previous thesauri developments using the same contemporary style of thesaurus construction selected by Project LEX. A list of the panel participants appear in Appendix 3.

Prior to each session a computer printout of candidate terminology in the subject field was prepared in several copies for the participants. The keys to selection by the computer were, of necessity, broad and ofter overlapping into other areas. This was purposeful since it could have been detrimental to the participants work to have arbitrarily cut too fine a line in the computer separation of the terminology. Selection instructions to the computer were sometimes based solely on the source. For example, terminology from the Atomic Energy Commission was all tagged for the session on Nuclear Science since this subject represented heavy AEC concentration. But the terms used by AEC which were not directly related to Nuclear Science could not easily be segregated by this computer process and hence were listed in the printout. This unavoidable clutter posed one of the problems for the panelists to resolve.

Some term lists in the data bank had been previously categorized by the source. DDC was the best example. Here, all items had previously been categorized by DDC's modified version of the COSATI SCL. A high order of relevance could thus be attained in pulling these terms from the data bank. Also, any similar terms submitted by other sources which were not categorized could be automatically associated and tagged. These printouts proved to be every effective tools for the panelists, not only in presenting a broad display of candidate terms, but also in giving helpful information and data for decision making.

The first half day of each new panel session was given to briefing and orientation. This was necessary because essentially a different group participated in each session. There is no doubt but that with each new session, the orientation was an improvement over the earlier ones. Experience dictated improvements where greater or lesser emphasis was needed, what need not be said, and what additional coverage was necessary. The following outline of topics generally describes the orientation coverage:

1. Background
   a. The need for thesauri
   b. Events leading to Project LEX
   c. Mission

d. DoD-EJC cooperative arrangement
e. Other cooperative aspects

2. Candidate terminology
   a. Data bank
   b. Work cards
   c. Other acquisitions
   d. Reference tools

3. Conventions
   a. Thesaurus construction
   b. Cross references and scope notes
   c. Alphabetization

4. Selection and arrangement of terms
   a. Criteria for selection
   b. Generic arrays
   c. Descriptor format
   d. USE references
   e. Work card instructions

5. Organization of working groups

In general, items 1, 2, and 3 above are given somewhat detailed treatment in other sections and in the Appendixes of this report. Items 4 and 5 will be discussed in the following paragraphs.

There were no hard and fast rules given to the panel participants for their selection of terms for the Thesaurus. Much leeway was given for personal and group decisions based upon professional knowledge and experience. However, guidance factors were provided to supplement their own judgement. These were given somewhat in the form of questions, the answers to which could be evaluated in determining the importance of a term or the concept. These questions were:

1. Was the term of a scientific or technical nature, and did it have authentic acceptability?

2. What was its demonstrated usefulness in (a) communications?, (b) indexing?, (c) retrieval?

3. What were the number of sources showing use of the term?

4. What was the frequency of use within any of the sources? (Whenever these figures or experience statistics were available.)

5. Was the term sufficiently unique that it might be selected without some kind of modification in form, or if it was not, could it be selected and made sufficiently unique with treatment provided for in the Conventions?

6. Did the term have a pertinent relationship with a broader subject that was being treated whereby its selection would help fill out a useful pattern?

The answers to these questions could largely be obtained from the preprepared work cards, from the data bank, or from other reference material. In many instances, participants themselves could add valuable usage information from their own, or their activities experiences. The selection process, then, was based upon consideration of these data and information. Every attempt was made to find a "home" for all useful scientific and technical concepts. This did not necessarily mean that a separate term would exist for every concept - but rather, that there would be a term that could be used with sufficient effectiveness. Where "homes" became too large or unwieldly, a division would be made by selecting more specific terms in the subject area.

Instructions were given the participants to first build generic arrays of candidate terms in related areas. The hierarchy of broader-narrower relationships could then be determined. Related terms, USE and Use For cross references, and the use of scope notes to clarify meanings could also be developed. The arrangement of words and word forms to make a descriptor were described under the general format elements provided for in the Conventions. These are summarized as follows:

1. Noun form.

2. Plural form for "count nouns," singular for "mass nouns."

3. Direct word arrangement.

4. Use hyphens only where necessary to clarify meaning.

5. No punctuations.

6. Qualifying parenthetical expressions to follow the term as a part of it.

7. Generally avoid:
   a. Acronyms

b. Abbreviations
c. Jargon
d. Identifiers (such as a coined name or model number).

8. Use "ing" suffix for processes.

9. Letter-by-letter sequencing.

10. Limit to 36 characters and spaces.

When unique terms could not be selected from the data bank for concepts that should be represented in the Thesaurus, descriptors were either to be established or scope notes were to be written in order to gain uniqueness as far as possible. Establishing new descriptors did not mean using words which had not been submitted in the reference material. Rather, it generally meant changing word forms, or adding or rearranging submitted words into the framework of the descriptors. One such example was the word "condensation." Because of its varied meanings, the word alone was not selected. Instead, the following descriptors were established to more specifically represent the concepts involved:

Atmospheric condensation
Condensates
  Used For - Condensation (materials)
Condensate wells
Condensate nuclei
Condensation polymerization
Condensation reactions
Condensation resins
  Used For - Condensation polymers
Condensation trails
Condensers (liquifiers)
Condensor tubes
Condensing
  Used For - Condensation (process)
Condensing steam drive
Retrograde condensation

The participants were given another method for dealing with a broad generic term having several quite different applications and yet of such importance that it might have occasional usefulness alone. Such terms were nicknamed "big daddy" descriptors. They were established with a standard explanatory scope note, with no hierarchical structuring, but followed by suggested terms related to the term's various concepts. An example "big daddy"

descriptor and its treatment is:

Losses 1407*

Scope note: Use of a more specific term is recommended; consult the terms listed below:

Core loss
Damage
Eddy currents
Fire losses
Head losses
Insertion losses
Lost circulation
Power loss
Rejects
Scattering loss
Seepage
Transmission loss
Wastes
Water loss
Yield

If extra large subject fields were established as descriptors, essentially equivalent in breadth to a Subject Category field or group, they were set up without structuring or cross references but with a scope note referring to the field or group in the Subject Category Index. This kind of descriptor was called a "super daddy." The following is an example of one that was established.

Physics 2000*

Scope note: For specific descriptors related to this broad subject consult the Subject Category Index.

The four digit number following the descriptor indicates that descriptors in all groups in field 20 (Physics) are pertinent.

Guidance for writing other scope notes was also given the panelists. This was still another "uniqueness" tool for gaining singularity of concept as far as possible. The scope note was not to be used if the hierarchical structuring, cross references, and the accepted definition of a descriptor were sufficient to make the intended concept clear. If not, a succinct statement was to be prepared directly pointing out any deviation in concept that should or should not be made.

*Indicates field (first two digits) and group (last two digits) in the Subject Category Index. In this example Physics is an entire field, hence no specific group is indicated.

A sample descriptor was always displayed for the panelists covering the above points as well as format and notation usage. Figures 3a and 3b show such a sample with explanations.

Also, detailed instructions were given on how to record decisions on the work cards. An example work card is shown in Figure 4. It shows the hand-written entries as recorded by the panelists for the descriptor Radar beacons as well as possible related candidate terms printed by computer from the data bank. A hand-marked "X" was used to reject an entry, an "A" was used to accept one. The figure was reduced in size to fit this report.

EXAMPLES
OF ENTRIES AND NOTATIONS
IN THESAURUS OF TERMS

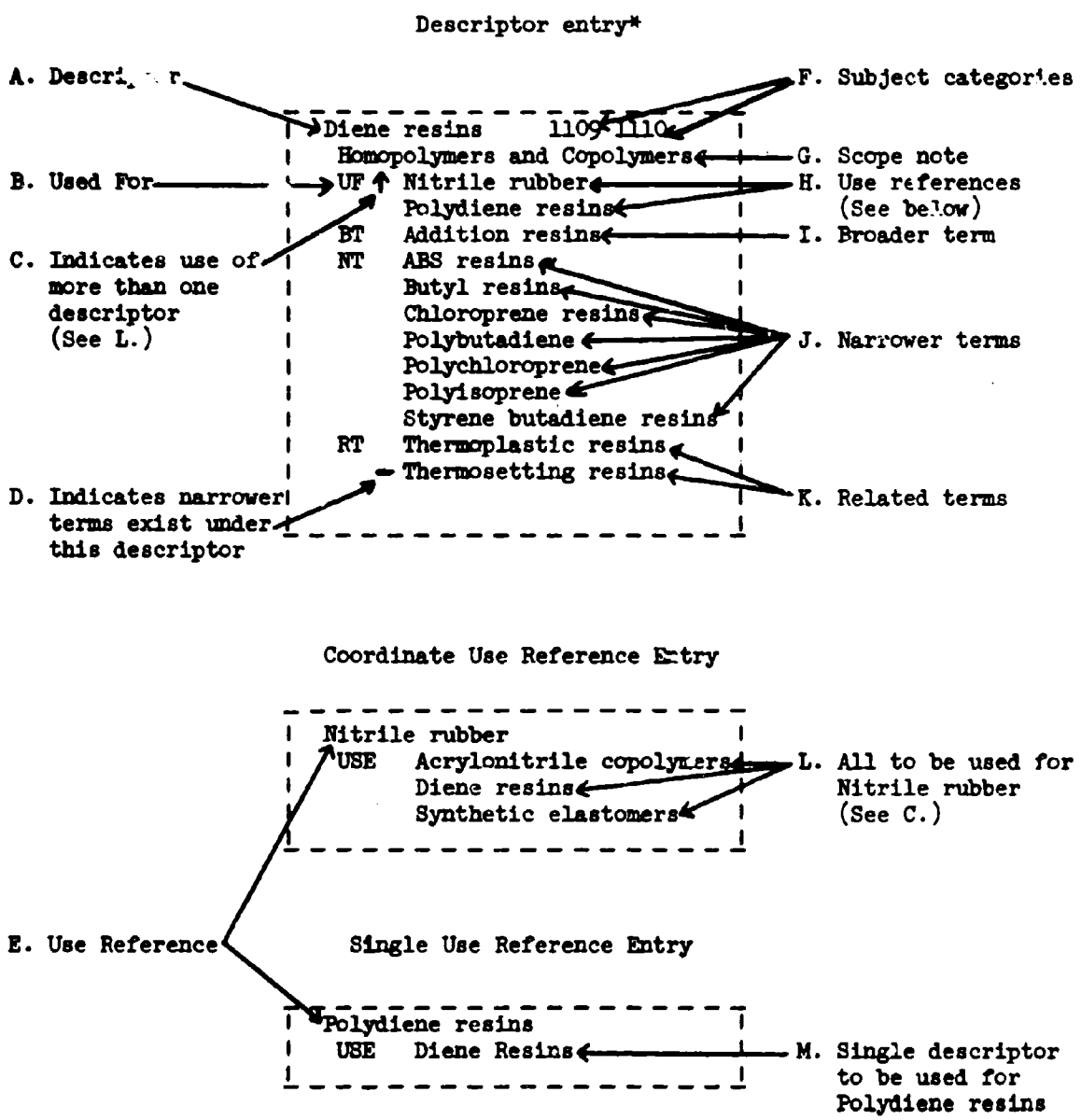

Figure 3a

EXPLANATION
(Refer to similar letters
on opposite page)

A. This is the main entry position for the descriptor. When in that position it appears in bold faced type.

B. UF = Used For. The descriptor at the main entry is to be used for any term listed under this notation. See E.where reciprocal entries are displayed.

C. The dagger (†) in front of a term signifies that two or more descriptors are to be used in coordination for that term. The term entry should be consulted to determine these descriptors. In this case Nitrile rubber has three USE descriptors (See L.) while Polydiene resins, without a dagger, has only one (See M.).

D. The dash (-) symbol in front of a descriptor indicates that the descriptor has narrower terms (not shown) and that the main entry should be consulted to determine these.

E. USE = USE reference. It refers the user to the preferred descriptor or descriptors. USE and UF reciprocate throughout.

F. The four digit numbers following each descriptor at its main entry indicate the Subject Category Fields (first two digits) and Groups (last two digits). Consult the Subject Category Index.

G. Scope Note. Used only when some clarification as to the descriptor's meaning may be needed.

H. These terms are USE references, not descriptors. They will appear as main entries in bold faced italics (See E.).

I. BT = Broader Term. Descriptors under this notation represent a generically broader class which includes the main entry descriptor as a lesser term.

J. NT = Narrower Terms. The reciprocal of I. above.

K. Related terms are not considered as belonging in the same generic class as the main entry descriptor; but as having close association or relationship to it.

L. All descriptors shown under USE should be used in coordination to represent the entry; both for indexing and searching. (This multiple USE situation occurs relatively few times.)

M. The single USE reference is the more common situation. One descriptor is used for one USE reference term.

Figure 3b

SAMPLE WORK CARD

ENGINEERS JOINT COUNCIL / PROJECT LEX THESAURUS — 606104

APR 29 1966 — AUTHORIZED TERMS — CANDIDATE TERMS — PAGE 1

606104 - -A ••••••••••••RADAR BEACONS ••••••••••••

LINE	ACTION	SC	TYPE	TERM DATA
0010	-A-	EJ	NT	RADAR BEACONS
	A			CTG 1707
~~0020~~	-X-	PJ	USE	RADAR HOMING
	A		BT	BEACONS
	A		BT	NAVIGATIONAL AIDS
	A		BT	RADAR EQUIPMENT
	A	DS	DF	RACON
	A		RT	Radar reflectors
	A		RT	POSITION (LOCATION)
	A		RT	RADAR TRANSMITTERS
	A		RT	RADAR RECEIVERS
	A		RT	BEACON ANTENNAS
	A		RT	RADIO TRANSPONDERS
~~A~~		~~RT~~		~~RADAR EQUIPMENT~~
A		RT		RADAR DETECTION

LINE	ACTION	SC	TYPE	TERM DATA
0011	-✓-	P-	NA	RADAR BEACONS
0031	-✓-	P-	NA	BEACONS
0041	-X-	P-	NA	C-BAND BEACONS
0051	-X-	P-	NA	DOPPLER BEACONS
0061	-✓-	P-	NA	POSITION (LOCATION)
0071	-X-	P-	NA	RADAR REFLECTORS
0081	-✓-	P-	NA	RADAR TRANSMITTERS

Figure 4

X.

EDIT AND REVIEW

At the end of the panel sessions in November 1966, over 20,000 terms (descriptors and USE references) had been established. There still remained a massive overhaul - or creating order out of the work performed by 21 sessions, each made up of a different group of people. Each had approached their own subject field without benefit of consultation with the others. Although much continuity was maintained by the staff and the work card records, there was sufficient clean-up and rearranging to make a large editorial task. Likewise, it was realized that the editorial work would have to include a search for important terms or concepts that had been missed. Just where and what they were was hard to immediately determine. Then there was the need to check for reciprocity of the cross references. Although efforts were made to do this double "book keeping" throughout the panel sessions, the continual construction changes that took place made manual completeness impractical, if not almost impossible. Another major task for this phase was the preparation and reviewing of the indexes. Along with all these matters was the usual work of editing for correctness, punctuations, spelling, and the writing and editing of the textual material. Finally, there was the task of placing the Thesaurus of Terms and the Indexes on magnetic tape suitably programmed for insertion to Linotron, the electronic controlled typesetting equipment at GPO.

All of these tasks depended heavily upon computer support as well as manual editorial treatment. To use the computer to utmost advantage, it was first necessary to keyboard the terminology and all the information resulting from the panel sessions. This was done on punch cards and then transferred to magnetic tape, thus making possible numerous approaches and editorial checks.

The first use of the tapes was to match them against the data bank tapes and run printouts of missing terms. These printouts included data on the missing terms which the staff used to determine whether or not the terms were of sufficient importance to be establish - or whether the concepts represented by the missing terms were already accounted for in previously established descriptors in different term form. Over 3,000 terms, descriptors and USE references, were added during this exercise and the tapes were then updated.

In order to make the most of the updated tapes, a clean corpus of terms was necessary. Printouts of just the terms - no cross references or other data - were carefully edited for accurate spelling, and term form. In fact, the computer did much of the job of completing the structuring of the descriptors. If a USE

reference did not have a reciprocating Used For descriptor, such was generated automatically but tagged so that the staff was alerted for possible decision. The same check was made with Related Term and Broader Term-Narrower Term reciprocity. During these runs an accurate clean-up was possible on spelling and term forms since matching would not be possible if terms were unlike. A progressive series of printouts and editorial reviews put the Thesaurus of Terms in readiness. The indexes were then made by computer.

XI.

DIVISIONS OF TEST

The main division of TEST was named the Thesaurus of Terms. All of the terms appear there, descriptors and USE references, interfiled letter-by-letter. The USE reference indicates the preferred descriptor and the descriptors display all hierarchical structuring, cross references, scope notes, and subject category assignments. Hence, this division is the one the user is instructed to consult for the full information that has been developed for the controlled vocabulary and to which he should refer if there is any question about the descriptor or its intended usage. Here the user will be aided in selecting the proper descriptor for the concept he has in mind by noting the broader terms, narrower terms, related terms, USE and Used For references, scope notes, and subject category assignments.

There are three indexes to the Thesaurus of Terms; the Permuted Index, the Subject Category Index, and the Hierarchical Index. If a term the user has in mind is not found in the Thesaurus of Terms, one of the indexes should be consulted.

Permuted Index

The purpose of the Permuted Index is to provide an approach to the terminology on a single word basis. Each significant word is listed as header words in alphabetic order and all descriptors and USE references containing that word arranged immediately below it in letter-by-letter sequencing.

Below is an excerpt from the Permuted Index.

* TRANSISTORS
.Bipolar transistors
Drift transistors
Field eject transistors
Junction transistors
Metal oxide transistors
MPN transistors
Surface barrier transistors
Unijunction transistors
TRANSIT
Rapid transit railways
.Transit mixed concrete
Transit mixers
Urban rapid transit
TRANSITION
Boundary layer transition
Ductile brittle transition

Glass transition temperature
Transition flight
Transition flow
Transition metals
Transition points
Transition probabilities
Transition temperature
TRANSITIONS
Electron transitions
Isomeric transitions
Phase transitions
* TRANSITS
* TRANSLATING
* TRANSLATION
Machine translation
Mechanical translation
* TRANSLATIONS

* Indicates that the leading word alone is a term (descriptor or USE reference) in the Thesaurus of Terms. Absence of the asterisk in front of the leading word indicates that it never appears alone - but is used in combination with the terms under it.
. Signifies USE references - consult Thesaurus of Terms for preferred term.

In this excerpt the leading words Transistors, Transits, Translating, and Translations are in themselves descriptors. The leading words Transits, Transition, Transitions, and Translation, are neither descriptors nor USE references. They appear only in combination with the actual terms shown below each. This permutation format is sometimes referred to as the KWOC style - key word out of context.

A permuted index for thesaurus terminology has an advantage over many other applications in that essentially all words are directly pertinent. The "not" list is very small. In addition to numerals that appear in a few terms, the list for TEST is as follows:

AND
BY
CARLO
DER
FOR
LIKE

OF
ON
ONLY
OR
PER
SAC
THE
THROUGH
TO
TRADEMARK
UP
WITH

As can be seen, there are several useful purposes for the Permuted Index. First, and probably most important, it gives the user the proper form for a multi-word term. The words in the descriptor Metal oxide transistors, shown in the excerpt, can be arranged in six different ways. Regardless of which word is used, the descriptor will be found in the Permuted Index in the proper word order. Six cross references would be necessary for the above descriptor in the Thesaurus of Terms to provide the approaches accomplished here with three listings. It thus provides a tool for conversion from indirect headings to direct headings.

Another important factor is that a high degree of generic accumulation is reached. For example, the kinds of transistors named in TEST are found in the permutation of Transistors. Of course, this is not always the case. For example, under Law may be found laws of science as well as laws of jurisprudence. Instructions for use of the Permuted Index suggest to the user that after he finds the descriptor he believes is proper he should confirm his selection by consulting the actual treatment in the Thesaurus of Terms.

Subject Category Index

As previously mentioned, one of the missions of Project LEX was to provide the Committee on Scientific and Technical Information (COSATI) with recommendations for any changes to the COSATI Subject Category List, 1964 (SCL), which might become apparent during the course of the Project.

Prior to Project LEX, no large interdisciplinary vocabulary had been built from start to finish around the framework of SCL. DDC had converted its already established thesaurus to fit a modified version of SCL. But it was felt that the makers of SCL, in issuing a revision, could profit from the practical experiences of an effort as broad in scope as the DoD-wide task. An honest

attempt was made throughout Project LEX to accommodate itself into the entire pattern of SCL. Only when changes seemed to be strongly dictated were they made in TEST. A record was kept of these as well as other possible considerations for changes. The result surprisingly favored the original SCL. Relatively few changes were actually required in fitting the final 17,810 descriptors into logical homes.

All of the changes that were made as well as the possible changes that might be considered were submitted to COSATI by ONR through the Office, Director of Technical Information, ODDR&E. The recommendations are included in report as Appendix 5.

In accordance with the SCL and the slight modifications found to be necessary, each descriptor was assigned to at least one field and group. The average number of assignments was 1.14 per descriptor. Instead of the COSATI numerical-alpha coding, a straight numerical coding was used for the fields and groups. The 22 COSATI fields remained with the same numerical assignment. The groups were given two digit numbers in lieu of the COSATI alpha arrangement. For example; the COSATI field and group 04B (field 04, Atmospheric Sciences - group B, Meteorology) was given the four digit number 0402, the first two digits representing the field, the last two, the group. This four digit number seemed more suitable for automation purposes and for eventual growth or expansion.

When all descriptors had been established and category numbers assigned, the Subject Category Index was computer arranged by accumulating the descriptors into their respective fields and groups.

Descriptors were categorized on the basis of rather general subject relationships rather than by the rigorous class membership criteria followed in giving the broader-narrower hierarchical treatment. Hence, the Subject Category Index provides an adjunct to other cross references to give further assistance in determining appropriate descriptor usage. Probably the greatest potential use lies in the effect the grouping has on information dissemination and the interchange relationships that might be developed between communication systems.

Hierarchical Index

The decision to include the Hierarchical Index came after long deliberations as to what might be the best method of presentation. Considerable thought was given to some kind of graphic

display, such as that used in the Euratom Thesaurus.* Three main points seemed to always arise to discourage any printed display.

The first was the large size of TEST. With over 17,000 descriptors, most hierarchical displays would have to be cut off at such a high generic level as to reduce the effectiveness. Second, no plan for a graphic display that would fit in TEST could be devised which offered additional information. In fact they all seemed to repeat information found elsewhere in simpler form. Third, a graphic display, when placed in print, was essentially frozen and not so readily admissible to change and growth as non-graphic displays.

One graphic display did merit consideration but it was not a printed version. This would be by means of computer generated, visible on-line cathode ray tube display. At any given time any descriptor might be displayed with its weighted relationships to other descriptors in the Thesaurus. This, of course, was beyond the mission of Project LEX. But the idea is nevertheless recorded here for possible future consideration. Both RAdm. J. K. Leydon, recently retired Chief of Naval Research and Mr. Walter Carlson expressed an interest in seeing further study undertaken on this idea. ARIES Corporation, the LEX contractor, did a brief investigation on their own resources and found promising possibilities, however, no funds have yet been made available to continue the work. Since Project LEX is terminated, any further efforts will depend on interests elsewhere.

The non-graphic display that was decided upon is the simple listing of descriptors with their families shown at descending levels. An excerpt from the Hierarchical Index readily demonstrates the format:

Nitro compounds
. Acyclic nitro compounds
. . Nitromethane
. Nitroaryl compounds
. . Nitrobenzenes
. . . Nitrophenols
. . . . Picric acid
. . . . Styphnates
. . . Trinitrotoluene
. Picrates
. . Ammonium picrates
. Tetryl

* European Atomic Energy Community, Euratom Thesaurus, 1st Edition, 1964, (EUR 500.o)

The descriptor families are based on the BT-NT relationships shown in the Thesaurus of Terms. Only descriptors which have no broader terms and do have two or more levels of narrower terms were selected as main entries for this Index. The hierarchy of other descriptors will be displayed at their normal positions in the Thesaurus of Terms. These most generic terms appear along the left margin of the column with the more specific terms below and indented to the right at their respective hierarchical levels.

In the above example Nitro compounds is the most generic. The dots in front of lower level descriptors indicate the number of levels each descriptor is below the head of the family. Picric acid and Styphnates are at the fifth level. This system provides an easy level reference for any point and for continuation of columns and pages without further level indicators.

If a descriptor belongs in two or more separate descriptor families, it will appear in each at its proper hierarchical level. Nitrophenols, at the fourth level in the above example, will also appear under Phenols, but at the second level. Likewise Picric acid and Styphnates will appear there at the third level. Each descriptor family is alphabetically located in the Index by its most generic descriptor with respect to all other most generic descriptors.

Users who wish to examine complete families of descriptors related to class membership should refer to the Hierarchical Index. Descriptors which were not given class membership assignments will not appear. This display will be most helpful where hierarchical search or indexing is employed. It will also be helpful in dealing with the more complex term taxonomies.

The Hierarchical Index represents one of the more sophisticated computer tasks performed by Project LEX. One has only to try such arrangements by hand to understand the complexity of the effort. The large size of TEST would have presented an almost insurmountable manual job.

XII.

PUBLICATION

Throughout the Project considerable thought was given to the arrangement, format, and printing specifications for TEST. Early estimates were that there might be close to 300,000 line entries. This was based on an estimate of 25,000 terms with all structuring and the three Indexes. (The final count was 23,364 terms and about 245,000 line entries.) Would one volume be sufficient? Or should there be two volumes, one for the Thesaurus of Terms and the other for the Indexes? Obviously, if the size did not become too unwieldy, the better situation would be one all-inclusive volume. Hence, this was the objective.

Numerous font types and sizes were examined and samples made. It was determined that a 6 point Trade Gothic type on 7 point spacing would be quite adequate for user purposes. Four columns per page, except for the Hierarchical Index which could have no more than three, were thus possible on an 8½" x 11" page. The length of each column would thus accommodate 97 lines, or 388 lines per page. These specifications would allow a one-volume product of about 700 pages and they were adopted.

The entire printing specifications for the Thesaurus of Terms and the Indexes is enclosed as Appendix 8.

TEST was one of the first printing jobs performed by GPO on its new high-speed Linotron. ARIES Corporation programmers worked in close liaison with GPO personnel in preparing the insert programs and the magnetic tapes. This new equipment performed the task in about two working days. This is comparable to some six man-months that might have been required by manual typesetting methods. Not all of this time was gained however, since it was necessary to wait almost three months from the time the material was ready before the Linotron was installed, debugged, and placed in operational readiness. It was also necessary for GPO to create a new grid for the Trade Gothic type in the type sizes, faces, subscripts, etc., that were necessary.

XIII.

B. ONR PROJECT LEX

From the inception of Project LEX it was understood that there would be a follow-on program. A useful thesaurus of scientific and technical terms should be a living thing. It should change and grow as science itself progresses. It has been estimated that in order to keep up with change and growth, an effective working vocabulary the size necessary for the programs of the Department of Defense will undergo some 1200 changes, additions or deletions during any given year. This means that TEST itself was out-of-date from the day the addition of new terms had to stop. The point argues against freezing a dynamic vocabulary on printed pages. The best that can be done with printing is to revise the printed volume as often as possible, either by frequent supplements or completely printed revisions or both. Certainly the point gives food for thought in the direction of computer techniques with visible on-line reference capabilities where the indexer, searcher or vocabulary builder will have updated information at all times.

The Director of Technical Information, DDR&E, realized that "there is a strong and continuing need in the Department of Defense for maintaining a comprehensive and up-to-date authority for the terms used to describe scientific and technical subjects." Such was reflected, as quoted, in the Foster Memorandum. The Memorandum also set forth a continuing responsibility . . each Service and Agency to maintain focal point representation to an on-going effort.

Based on these facts the Project LEX Focal Points, with the Project Director as Chairman, drafted and presented a plan to the Director of Technical Information via the Chief of Naval Research, for a program that would continue after termination of LEX. The plan is enclosed in this report as Appendix 9.

The Project LEX Focal Points were silent on the matter of a home for the continuing effort. There was some discussion favoring the Office of Naval Research since, with Project LEX, it had an established operating element. But ONR had accepted the responsibility with the understanding that its part would be concluded with the preparation of TEST, the Conventions Manual, and the COSATI recommendations. No other charge had been given. Also, ONR had a strong feeling that its best contribution was made by creating the pattern and the first DoD-wide thesaurus under a scientific and technical environment. After that, it believed the best location for a day-by-day on-going task should be in a day-by-day on-going operation in the technical documentation business where the raw products for updating were readily accessible and were put to use.

The Defense Documentation Center for Scientific and Technical Information (DDC) was considered the ideal location and such was recommended by the Chief of Naval Research in his endorsement of the plan to DDR&E.

Shortly after the plan was forwarded, DDC was assigned the responsibility for the on-going task. The assignment closely followed the recommendations set forth in the Project LEX Focal Point Plan.

A three-step phase out of Project LEX and transfer to DDC was as follows:

1. 31 May 1967. Thesaurus work terminated and assigned staff personnel returned to parent activities. Five billets transferred to DDC. Manuscript printout of Thesaurus furnished to DDC.

2. 31 July 1967. Work records generated by Project LEX and reference materials made available to DDC.

3. 31 December 1967 (or earlier). Primary distribution of TEST made by LEX. Transfer of 10,000 copies of TEST to DDC for secondary distribution. Remaining two billets transferred to DDC.

Project LEX was terminated before work could be undertaken on finalizing the establishment of the terms as standard data elements. This responsibility was assigned as a continuing arrangement (see Appendix 1) with the technical vocabulary efforts. Project LEX had moved through the first part of this program by establishing the terminology. The remaining tasks of preparing definitions and establishing the terms as standards through DoD coordination was thus transferred with the on-going effort to DDC.

The complete terminology with all data was made available to EJC and DDC on magnetic tapes. This was for purposes of their on-going efforts as well as to fulfill the needs of others to whom duplicate tapes might be furnished. The tapes are formatted in IBM 360 mode and a brief description of the layout is shown in Appendix 10.

XIV.

RESULTS

Some facts and figures believed to be of interest are recorded here. Many statistical studies might well be made, and no doubt will, which would be of interest to thesaurus users and builders. The figures listed here are only those which became readily apparent during the progress of the work and were not made in light of a study or analysis of TEST.

As previously noted, there are 23,364 terms in TEST. 17,810 are descriptors, 5,554 are USE references. Figure 5 is a source distribution graph showing the percentage of the terms which were contributed by 1 or more, 2 or more, 3 or more, etc., sources. There were 145 source lists in the data bank. 86.8% of the 23,364 terms were in one or more of these source lists. 3.6% were in twenty or more. It may be noted that 16.6% of the terms were contributed by only one source list - 12% by two, and so on, and that the scale shows a descending order as the contributing sources increase. An interesting point here is that 13.2% were in no source list, being generated as new terms by Project LEX. To understand this, one must realize that all concepts and all words existed in some form and that in following the Conventions and in creating uniqueness it was often necessary to change to word form or the term form. This might have been by only changing from the singular to the plural form of a word, or changing a suffix from "ion" to "ing," and so on. Also, it was sometimes necessary to add, delete, or rearrange words in a compound term in order to differentiate between synonyms or homographs or to otherwise clarify the usage intent.

Figure 6 is a chart of the "vital" statistics of TEST. Many more could have been tabulated, but these are felt to be the important facts describing the contents of the book.

It is interesting to note that 64.5% of the terms have more than one word. Also, while there are 23,364 terms, there were only 13,010 words used to make ... Since the attempt was made to have each term represent a unit concept, it may be seen that single words could not have done the job without creating new words or without making some kind of changes or truncations to existing words. This would have required development of another kind of lexicon.

SOURCE DISTRIBUTION FOR

TERMS IN TEST

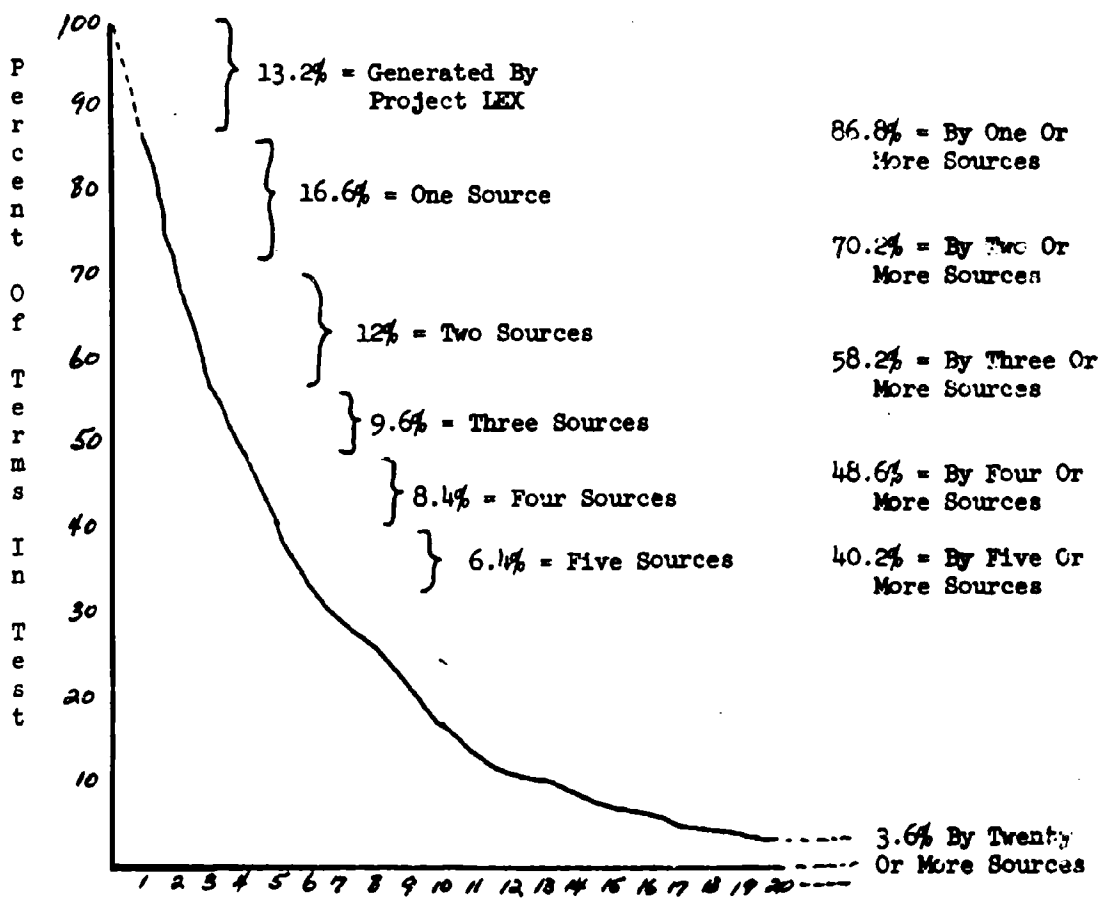

Figure 5

STATISTICS

Thesaurus of Terms	
Descriptors	17,810
USE References	5,554
Total terms	23,364
Scope Notes	1,178
Used For's	6,102*
Broader Terms	23,907
Narrower Terms	23,907
Related Terms	76,257
Line entries	162,657
Avg. number of entries under each descriptor	7.48
Descriptors having one or more BT's	11,424
Descriptors having one or more NT's	3,512
Descriptors having one or more RT's	14,792
Percent of One-word terms	35.5
Percent of Two-word terms	52.2
Percent of Three-word terms	10.8
Percent of Four-word terms	1.5

Permuted Index	
Line entries	47,758
No. of Unique words	13,012

Subject Category Index	
Line entries	20,223
Descriptors	17,810
Avg. Categories per descriptor	1.14

Hierarchical Index	
Line entries	13,310
Descriptor heads of families	607
Avg. number of entries per descriptor	21.9

* The difference between this figure and that for USE references is caused by several USE references having more than one USED For.

Figure 6

XV.

CONCLUSION

TEST is not the last word in a technical thesaurus, nor will there ever be. Because of the large effort, there may be erroneous feelings that TEST should answer all needs. If it has closed but a small gap in the streamlining of information communications, those who had a hand in its making will be most gratified. But continuous surveillance of terminology will be an ever-demanding problem.

In the earlier thesaurus efforts at ASTIA and DDC it was sometimes remarked in an off-hand way, "if we have more help we will never get it done." There is more truth than ne might suspect behind this statement. The point here is that had Project LEX worked with a small secluded staff of lexicographers, isolated from everything except the raw terminology and a few reference tools, a thesaurus could have been built at much less cost and in less time.

Seeking the advice and cooperation of others, even though such advice and help is contributed, actually increases the overall operational costs; time-wise, man-power wise, and dollar-wise. However, to decrease this kind of operational environment would have been to decrease the value of the final product.

Project LEX, realizing this trade-off, made concerted efforts to get advice, cooperation, and input assistance from many sources. The response was far greater than anticipated. Especially gratifying was the cooperative arrangement with Engineers Joint Council. Much experience from the engineering community was added to the large input from the Department of Defense and its many research, development, test and engineering interests. All of this increased the effective and authoritative nature that had been intended from the beginning.

Finally, a word of appreciation needs to be said for those who had the responsibility of putting TEST into print. All along the line, from the publication people at the Naval Research Laboratory and the ARIES Corporation programmers through those involved at the Government Printing Office, dedicated efforts were made. The decision to electronically photocompose the book by Linotron was to cross a new threshhold in advanced printing techniques. Project LEX was happy to have had a part in this venture.

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APPENDIX 1

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Appendix 1

DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D.C. 20301

October 12, 1965

MEMORANDUM FOR THE SECRETARY OF THE ARMY
THE SECRETARY OF THE NAVY
THE SECRETARY OF THE AIR FORCE
THE ASSISTANT SECRETARY OF DEFENSE (COMPTROLLER)
THE ASSISTANT SECRETARY OF DEFENSE (INSTALLATIONS & LOGISTICS)
THE ASSISTANT SECRETARY OF DEFENSE (SYSTEMS ANALYSIS)
THE DIRECTOR, ADVANCED RESEARCH PROJECTS AGENCY
THE DIRECTOR, DEFENSE ATOMIC SUPPORT AGENCY
THE DIRECTOR, DEFENSE COMMUNICATIONS AGENCY
THE DIRECTOR, DEFENSE INTELLIGENCE AGENCY
THE DIRECTOR, DEFENSE SUPPLY AGENCY
THE DIRECTOR, NATIONAL SECURITY AGENCY

SUBJECT: DoD-Wide Technical Thesaurus

There is a strong and continuing need in the Department of Defense for maintaining a comprehensive and up-to-date reference authority for the terms used to describe scientific and technical subjects. The inter-disciplinary character of science, engineering, and other technologies is recognized in such DoD activities as requirements studies, intelligence estimates, program planning, budget analysis, research and development, operations, supply, maintenance, and the documentation associated with these activities. Effective communication and understanding between disciplines, at all echelons of management, depends upon access to a consolidated record of how the specialized languages are actually used.

The need for a thesaurus-like reference authority to technical terminology is recognized throughout DoD and the Defense contract program. The diverse and uncoordinated efforts now underway in the Army, Navy, Air Force, Defense Supply Agency (including the Defense Documentation Center), and the Defense Intelligence Agency illustrate the urgency for DoD-wide action. To avoid duplication of effort and to mobilize the currently applied resources for greater effect, I believe that DoD should have a single project to which all DoD components can contribute and on which DoD contractors and the professional societies can focus their participation.

Each of the Military Departments and the Defense Agencies has been surveyed by the Director of Technical Information, ODDR&E, to consider whether it could assume responsibility for DoD-wide coordination of the technical thesaurus project. This review indicates that the most attractive alternative

is to organize the project within a scientific and technical unit which has professional talent covering a wide range of subjects and to establish a project task force there to do the job.

The Office of Naval Research is hereby designated as the organization in DoD responsible for preparation of an authoritative inter-disciplinary technical thesaurus. Detailed program discussions have been held with ONR.

The Assistant Secretary of Defense (Installations and Logistics) will designate this project as the official DoD standardization effort on technical thesaurus in a memorandum to be issued separately.

The Assistant Secretary of Defense (Comptroller) will designate the Office of Naval Research as the Assigned Responsible Agent (ARA) for preparing an authoritative technical thesaurus as part of the Data Elements Standardization Program. The memorandum of assignment will be forwarded shortly.

The Work Plan and an approximate time schedule have been developed and are hereby approved as the official scope of the technical thesaurus project. They are attached as Enclosure 1.

A full-time task force will be established within ONR. Personnel for the task force will be assigned and organized in accordance with the schedule shown in Enclosure 2.

A statement clarifying the intent of a thesaurus as compared to a dictionary or glossary is attached as Enclosure 3. This memorandum is concerned only with thesaurus activities.

All addressees of this memorandum are requested to provide assistance to the project as set forth in the Enclosures.

Each addressee of this memorandum is requested to make an immediate review of current or proposed in-house and contractual efforts in the field of technical thesaurus construction and maintenance, and to suspend such efforts in favor of concentrating the resources so engaged into the new task force project. Any technical thesaurus effort that must be continued shall be submitted to my office for review and approval. Where approval is given, it will be with the understanding that the DoD-wide project has precedence and coordination with it will be required.

Properly conducted, with strong participation by all pertinent elements of the Defense community, this new project can have an important and favorable future impact on the effectiveness of technical communications in all echelons of DoD and in all phases of the Department's work. Your prompt attention and adherence to the proposed schedule will be greatly appreciated.

John S. Foster, Jr.

JOHN S. FOSTER, JR.

Enclosures 3

Appendix 1

Enclosure 1

WORK PLAN - DOD-WIDE THESAURUS

Purpose: To develop and publish a scientific and technical thesaurus for use by all elements in the Department of Defense, and their contractors, who are engaged in the management and execution of research, development, engineering, design, procurement, supply, and maintenance.

Products Desired:

1. A manual setting forth DoD conventions for thesauri building.

2. A thesaurus of scientific and technical descriptors devised from terms or concepts essential to the storage and retrieval of information or data related to DoD research, development, engineering, design, procurement, supply, and maintenance, and arranged in format or formats that will provide:

a. Definition or scope notes that will as clearly as possible show the uniqueness of each term, its generic relationship with others, and with appropriate cross reference;

b. Orderly arrangements in natural language that will afford rapid and straightforward approaches for different kinds of usage;

c. Relationship of the whole to the COSATI Subject Category List;*

d. Codes for machine manipulation; and

e. Indexes as may be necessary for usage guidance.

3. Recommendations for any changes in the COSATI Subject Category List that may become apparent during the course of the work.

Approach: The work will be performed by a full-time task force, supplemented at intervals with representatives from DoD operating and contractor activities who are directly concerned in one or more specific subject fields.

The group will be set up in a separate working area provided by the Office of Naval Research. ONR will provide the Project Director and clerical personnel and will also provide supporting office supplies, equipment, and assistance where needed in reproduction and occasional computer time with the required operating and programming personnel. The Project Director may arrange for consulting service, either from within ONR or from outside sources, as such may become appropriate.

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*The COSATI Subject Category List has been issued by the Committee on Scientific and Technical Information of the Federal Council for Science and Technology as the official government-wide technical vocabulary for document announcement, security control, and management reporting.

The work will be given priority, and the schedule reflected in the following time-table will be met as closely as possible. Some changes in plans may be necessary as the operations proceed, but the terminal date should remain fairly firm.

Time Table:

Event No.	Event	Target Date
1.	Letters out to Services submitting plan and requesting assistance and task force assignments.	12 Oct 65
2.	Complete space and equipment arrangements.	29 Nov 65
3.	Personnel assignments made.	29 Nov 65
4.	Task Force convenes - actual work begins.	13 Dec 65
5.	Identify and list areas and activities to be covered. Prepare work schedule chart.	20 Dec 65
6.	Coordination draft of conventions and guidelines.	30 Dec 65
7.	Approval or comments of #6 received.	14 Jan 66
8.	Complete conventions and guidelines for publication.	28 Jan 66
9.	Collection of pertinent vocabularies and tapes or punch cards (where available).	4 Feb 66
10.	Identify compatible terms or concepts in various lists and those requiring resolution of differences.	28 Mar 66
11.	Complete preliminary compatible concept list showing inclusions, exclusions, and cross references to accommodate concepts and make preliminary assignments to COSATI SCL.	15 Aug 66
12.	Conclude series of meetings and contracts with representatives from various subject or activity areas.	26 Sept 66

Appendix 1

Event No.	Event	Target Date
13.	Complete semi-final compatible list, COSATI SCL assignments, and scope notes.	14 Oct 66
14.	Complete check and clean-up.	4 Nov 66
15.	Complete index or indexes.	11 Nov 66
16.	Final draft prepared.	9 Dec 66
17.	Final coordination complete.	7 Jan 67
18.	Final refinements and clean-up.	27 Jan 67
19.	Codes for computer input.	10 Feb 67
20.	Prepare computer tape.	24 Feb 67
21.	Run Manuscript copy and release to printer (GPO).	15 Mar 67
22.	Issuance	April 67

Appendix 1

Enclosure 2

TASK FORCE COMPLEMENT

For DoD-Wide Thesaurus Project

The full-time task force will be a 14-man team; 11 professional (preferably in the GS-11 to GS-15, or comparable grades) and 3 clerical. The breakdown of this team and the approximated total man-years in accordance with the time schedule for preparation of a first edition is shown below. Each Department or Agency named will be responsible for supplying the number indicated, or for a transfer of funds to ONR in the amount necessary to support contract personnel in lieu of in-house personnel. Arrangements will be made by ONR for supplementing the effort on a contract basis.

Professional Personnel	No.	Total Man/Yrs.
Office of Naval Research (Project Director)	1	1¼
Army	2	2½
Navy	2	2½
Air Force	2	2½
Defense Documentation Center	2	2½
National Security Agency	1	1¼
Defense Intelligence Agency	1	1¼
	11	13 3/4
Clerical Personnel		
Office of Naval Research (1 Secretary; 2 Stenos or Clerk Typists)	3	3 3/4
Total	14	17 1/2

The above personnel assignments are required from each of the Services and Agencies listed. Each civil service employee assigned will be responsible to the Project Director. It is anticipated that the Project Director will be the Project Officer for such contract service that may be required.

The professional staff of the task force should be made up of individuals who represent the highest qualifications for scientific and technical vocabulary building in their respective Military Service or Agency and within the grade levels indicated above. The Army, Navy, Air Force, Defense Documentation Center, DIA, and NSA will each designate an individual or an office to serve as its focal point for internally coordinating the effort and assuring input to the project from its related interests. Each of the other Defense Agencies not named will have the option of designating a focal point representative who may serve full- or part-time on the task group as the needs of each may dictate. ONR will be informed of all focal point designations prior to 20 October 1965.

In coordination with the respective Services and Agencies, the Project Director may arrange for alternates for the regular members, or for part-time additional assignments, when it is deemed important to bring specialized skills to bear on the project. Continuity of effort and thoroughness of coverage will be the prime factors governing these moves.

Short-term working panels (usually from one to five days) may be scheduled by the Project Director from time-to-time. These will be scheduled when specific subject or usage areas are to be considered by the task force and for such duration as the Project Director may determine for optimum input. Working panels will be formed on an invitation basis with full expenses born by the activity they represent. Pertinent DoD in-house and contractor activities as well as non-DoD government activities may be included. Focal points will assist in seeing that this opportunity is extended to pertinent activities or contractors within their respective agencies.

Also, it may be anticipated that the Project Director or focal point representatives will find it essential from time-to-time to seek consultation with scientists or engineers concerning terminology in special fields. Cooperation in this respect will be highly desireable.

Although the project will be considered as terminated with completion of the first edition manuscript and other products that have been listed in Enclosure 1, the focal point representatives should continue to be recognized by each Service and Agency for continuation on a limited basis for further collection, refinement, and building of vocabulary terms which will eventually lead to future revisions.

Appendix 1

Enclosure 3

A THESAURUS AS COMPARED TO A DICTIONARY OR GLOSSARY

As is usually the case with closely related articles or tools, the principal difference between a thesaurus and a dictionary or glossary lies in the use for which each is intended. It is the purpose here to briefly describe the purpose of a thesaurus and how it differs with a dictionary or glossary as a vocabulary tool.

For indexing purposes, librarians and documentalists have long faced the problem of reducing the words in the text of an article or book to a few key words or descriptive terms. This is forced upon them simply because it is both impractical and illogical to index every word. The same situation is faced when one searches a collection of documents for information. He must reduce his question to the principal words or terms describing his subject area, else he would be lost in a maize of useless approaches. Hence, a common subject matter guide for both indexer and searcher is essential.

The logical arrangement of words and combinations of words to meet this need has taken many forms. Subject classification systems for placing generically related kinds of knowledge together have been most prevalent--such as the Dewey Decimal Classification System and the Library of Congress Classification System. In recent years "subject heading" lists for specialized collections have been heavily used. "Descriptors" and "uniterms" are other variations for arranging a vocabulary to afford ways and means to control knowledge in the bibliographic processes.

With the coming of automation, a thesaurus-like arrangement of terms has aided the user of subject terminology by adding clarification of synonyms, antonyms, homographs and hierarchical relationships. This clarification becomes of increased importance where manual or eyeball inspection is eliminated after computer or mechanized techniques take over.

Unlike dictionaries or glossaries, none of the lists or arrangements referred to above carry definitions as such. Although definition is implied throughout their organization, the major purpose is not to define. The thesaurus is tailored to provide an authoritative guide or road map to subjects, broad and narrow, with forward and back approaches for effective storage, retrieval, and communication processes.

There is also a difference between "word" and "term" as we think of scientific and technical thesauri. The emphasis here is on the "term." A term may be a single word, or it may be a combination of words. Each term represents a concept or a unit of information. This is quite different from a dictionary which essentially deals with single words.

Generally, a glossary also deals with terms as well as separate words. But a clarifying definition for a particular use is involved and an arrangement showing hierarchical relationships or classification of subject matter is seldom used. According to Webster, a glossary is a collection of glosses, and a gloss is a difficult word needing explanation or interpretation. It is a partial dictionary.

It should be noted that, in the building of a thesaurus, dictionaries and glossaries furnish important guidance. Definitions and interpretations combined with usage in the literature itself provide the key to the thesaurus arrangement.

Finally, whereas dictionaries and glossaries are generally used for the purpose of defining words or terms, an almost inverse use is the role of the thesaurus: to assist in identifying the term to fit the concept.

Appendix 1

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D. C. 20301

COMPTROLLER
(Management)

December 2, 1965

MEMORANDUM FOR SECRETARY OF THE NAVY

SUBJECT: Assignment of Data Elements and Data Codes Standardization Responsibility - DoD-Wide Technical Thesaurus

Under the provisions of DoD Directive 5000.11, "Data Elements and Data Codes Standardization Program," dated December 7, 1964, and DoD Instruction 5000.12, "Data Elements and Data Codes Standardization Procedures," dated April 27, 1965, the Navy is designated as the Assigned Responsible Agency (ARA) for the development, coordination and recommendation to Assistant Secretary of Defense (Comptroller) of standard data elements and related features which are to be reflected in the DoD-Wide Technical Thesaurus and their subsequent maintenance. As indicated in DDR&E memorandum of October 12, 1965, "DoD-Wide Technical Thesaurus," the Office of Naval Research has been agreed upon as the action office for this assignment.

Guidelines and procedural steps for operation of the work groups assembled for this project are set forth in Enclosure 1 of DoD Instruction 5000.12. It should be noted that the data standardization group and the Thesaurus group are the same. To provide appropriate coordination, the representatives of the DoD components designated as points of contact for data element standardization matters (Enclosure 1) must be aware of pending actions. Each must know who, in his organization, is assigned to working groups on data standardization. Therefore, the names of members participating in the working group, representing his component, should be sent to these points of contact. Additionally, the coordination required by DoD Instruction 5000.12 should be accomplished by forwarding the proposed data element recommendations to these points of contact.

The Thesaurus is intended to afford a cross-reference list of scientific and technical concept-terms (or -words) mainly for use in information retrieval. The Thesaurus itself will be computerized and, as such, is a data system and parts or all of it will be applicable to more than one information retrieval data system. Therefore, all of the terms within the Thesaurus are subject to standardization. This

objective should be borne in mind from the outset. Although the procedures for establishing a Thesaurus-like terminology and standard data elements are somewhat different, there are sufficiently common grounds to permit a considerable degree of concurrent effort. The main differences are in the mechanics of establishment and presentation. The intellectual exercise in both cases is quite similar and full advantage should be taken of this similarity. Much of the analysis work done in compiling the Thesaurus will be usable as an initial step in standardizing data elements. Data elements must be defined and standardized one at a time. Preliminary lists of terms made in the Thesaurus effort can be the first step in such definition. Also, it is essential that the data systems requirement of all DoD functions and organizations using the same or related data elements be considered in data standardization.

In many cases, the concept-terms which will appear in the technical Thesaurus will be the same as those used in other DoD data systems in addition to information retrieval systems. As such, they may already be or may be subject to become standard data elements. To assure consistency between the terms used in DoD data systems and in the official DoD reference authority, wherever possible, the standard data elements included in the Thesaurus should be so identified. The standard data elements included in the Thesaurus will appear, along with all other DoD standard data elements, in a standard data publication with their related standard data items and codes and data use identifiers. It is suggested that some reference to the standard data publication be included in the Thesaurus and an identification of the standard data elements so listed. Enclosure 2 provides specific assistance in the standardization assignment. Through representation on the the project briefing sessions, ASD(Comptroller) will be continually informed as to progress and guidance can be given in the appropriate direction for data standardization.

Representatives of the Data Standards Division will be available to give briefings, as required, and to provide guidance and assistance in applying the criteria and procedures to identify, develop, define and code recommended standard data elements and related features. Questions concerning any of the material or guidance furnished or any other aspects of the Program should be brought to the attention of this Division for resolution at the earliest possible opportunity.

W. Carl Blaisdell
Deputy Assistant Secretary of Defense

Enclosures - 2
1. List of Points of Contact
2. Specific Data Standardization Assistance

Appendix 1

C O P Y

10 November 1965

AR

MEMORANDUM FOR The Commanding General, U. S. Army Materiel Command,
Attention: AMCTD-S
The Chief of Naval Material, Department of the Navy,
Attention: MAT-233
The Deputy Chief of Staff, Systems and Logistics,
Department of the Air Force, Attention: AFSPPER
The Director, Defense Supply Agency, Attention: DSAH-SEC

SUBJECT: DoD-Wide Technical Thesaurus

Project MISC-0359 is hereby established and assigned to the Department of Navy for management. The Office of Naval Research is designated as preparing activity. The Departments of the Army and Air Force, and the Defense Supply Agency are requested to advise the Navy Departmental Standardization Office of their custodians for this project.

The scope of this project and plans for its completion are contained in the memorandum dated October 12, 1965 to DoD components from John S. Foster, Jr., ODR&E (copy attached).

(Signed) William C. Nichols
Lt. Col., USAF
Assistant Deputy Director
Office of Technical Data
and Standardization Policy

Enclosure 1

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APPENDIX 2

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Appendix 2

DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH
WASHINGTON, D. C. 20360

IN REPLY REFER TO

PROJECT LEX
FOCAL POINT MEMBERS

ARMY
Mr. Parmely Daniels
Office of the Chief,
Research and Development
3045 Columbia Pike
Arlington, Virginia 22204

NAVY
Mr. Robert J. Mindak
Office of Naval Research
Code 403M
Navy Department
Washington, D. C. 20360

DASA
Lt. Colonel John E. Preston
Defense Atomic Support Agency
1B728 Pentagon
Washington, D. C. 20301

SECRETARY OF DEFENSE, OFFICE OF
Miss Mildred Bailey
ASD - Comptroller
5A875 Pentagon
Washington, D. C. 20301

NSA
Miss Agnes Oberwortmann
National Security Agency
Fort Meade, Maryland 20755

DIA
Colonel Davis Potter
Defense Intelligence Agency
Washington, D. C. 20301

AIR FORCE
Major Clayton Schlemm
Air Force Systems Command - SCTN
Andrews Air Force Base
Washington, D. C. 20331

DDC
Mr. Paul Klingbiel
Defense Documentation Center (DDC-V)
Cameron Station
Alexandria, Virginia 22314

Appendix 2

OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

6 January 1966

MEMORANDUM FOR THE PROJECT LEX FOCAL POINTS

SUBJECT: Mission Statement

The multiple address memorandum of 12 October 1965 from the Director of Defense Research and Engineering established a project to prepare a DoD-Wide Technical Thesaurus under Office of Naval Research cognizance (since named Project LEX). This memorandum delineates the responsibilities of focal point representatives as provided in the 12 October 1965 memorandum.

> "The Army, Navy, Air Force, Defense Documentation Center, DIA, and NSA will each designate an individual or an office to serve as the focal point for internally coordinating the effort and assuring the input to the project from its related interests. Each of the other Defense Agencies not named will have the option of designating a focal point representative who may serve full- or part-time on the task group as the needs of each may dictate."

The focal point individual or office is the liaison between the entire Military Department or Defense Agency thus represented and Project LEX. Individual and direct communications are expected between the focal points and Project LEX as well as between the focal points and all activities within their respective Departments or Agencies. Much of the communications with the Project will be through meetings called and chaired by the Project Director at regular intervals. Individual contacts may be made on matters concerning a single Department or Agency at any time.

The following are typical of the functions to be performed by each focal point:

a. Attend focal point meetings and keep himself informed of the progress and status of Project LEX. Also, inform others in his Department or Agency who are concerned with development and standardization of technical terminology.

b. Take such steps as may be necessary to insure that the Project receives input from his Department or Agency in any or all of the following areas:

(1) Supply of existing technical terminology from all DoD activities ranging from research through development and procurement to supply, operations, and maintenance.

(2) Representation on the task force, or funds in lieu thereof, as required by DDR&E memorandum of 12 October 1965.

(3) Representation at scheduled subject area sessions by specialized technical personnel from affected in-house installations.

(4) Requirements for data element standards employing technical terminology.

(5) Evaluation of technical terminology submitted to Project LEX by contractors, trade associations, professional societies, and other government agencies.

c. Obtain appropriate official action of his Department or Agency on matters that may require coordination, approval, or comments as determined or identified by the Project Director.

/s/ Walter M. Carlson
Walter M. Carlson
Director of Technical Information

cc: Chief, Office of Naval Research
Director, Project LEX

(Verso Blank)

APPENDIX 3

(Verso Blank)

Appendix 3

PANEL PARTICIPANTS

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Kenneth C. Back, Aerospace Medical Research Laboratories
Stanley Backer, Massachusetts Institute of Technology
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Dr. Bryon B. Baker, Jr., Naval Oceanographic Office
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John Baldwin, Defense Documentation Center
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Appendix 3

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Arthur Jay Ziffer, Naval Research Laboratory
W. E. Zuhn, Army Missile Command, Redstone Arsenal

Appendix 3

SCHEDULE FOR PANEL SESSIONS

April 25 - May 6	Materials
May 9 - 13	Nuclear Science and Technology
May 16 - 27	Military Sciences *Instrumentation and Metrology *Applied Mathematics, Computers, and Operations Research
May 31 - June 10	Aeronautics, Missile, and Space Technology
June 13 - 24	Navigation, Communications, Detection, and Countermeasures *Petroleum Exploration and Mining
June 27 - July 1	Propulsion, Fuels, and Energy Conversion *Industrial and Management Systems
July 5 - 15	Electrical and Electronic Engineering
July 18 - 29	Mechanical, Industrial, Civil, and Marine Engineering
August 1 - 9	Chemistry
August 22 - 26	Ordnance
August 29 - 31	Agriculture
September 1 - 2	Methods and Equipment
September 6 - 9	Behavioral and Social Sciences
September 12 - 19	Biological and Medical Sciences
September 20 - 26	Earth Sciences and Oceanography
September 27 - October 5	Atmospheric Sciences, Astronomy, and Astrophysics
October 10 - 19	Physics and Mathematical Sciences

*Concurrent EJC panel sessions.

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APPENDIX 4

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ENGINEERS
JOINT
COUNCIL

345 EAST 47TH STREET, NEW YORK, N. Y. 10017
(212) PL 3-6580 • CABLE - ENJUNITY

June 3, 1966

Mr. J. Heston He .6
Director, Project LEX
Office of Naval Research
Navy Department
Washington, D. C.

Re: Record of Understanding on EJC/LEX thesaurus
Revision Cost Obligations

Dear Heston:

Following is my understanding of what we decided in your office recently as to the obligations that EJC and Project LEX assume with regard to the materials and processing costs of the thesaurus input material and the final DoD and EJC thesauri.

I agreed that EJC will pay all the Westinghouse computer processing costs for preparing input material including the 20,000 work cards and the microfilm display of the EJC input data.

You agreed that Project LEX will pay for the card stock used in preparing the work cards according to the bill yet to be received from Westinghouse and will pay EJC for the use of the two tapes, one of the EJC thesaurus and the other of the EJC merged input data from 65 sources that was sent to Aries Corporation at your request. The price for the two tapes is to be negotiated.

You agreed that Project LEX assumes obligation to EJC to pay for computer processing of the final thesaurus including keypunching of data from work cards and checking of all cross-references for reciprocal entries. EJC will make available to Project LEX without charge the computer programs for thesaurus processing and cleanup developed for EJC by Auerbach Corporation. EJC will select from the entire EJC/LEX completed thesaurus those terms to be included in the EJC thesaurus. You agreed that Project LEX will prepare for EJC without charge a final tape of the EJC thesaurus in linear format. Project LEX will further

prepare for EJC without charge, by arrangement with the Government Printing Office, a graphic arts quality camera-ready copy of the thesaurus in page format complete with running heads, footnotes, etc., according to typographical specifications yet to be agreed upon.

You agreed that Project LEX will also make available to EJC without charge a magnetic tape of the final DoD thesaurus in linear format for unrestricted use.

Please let me know if the above is an accurate statement of our understanding.

Sincerely yours,

(signed)
Frank Y. Speight
Director
Information Program

FYS:jw
cc: Mr. Robert Dodds
Mr. Norman Cottrell
Mr. Carl Frey

Appendix 4

DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH
WASHINGTON, D. C. 20360

IN REPLY REFER TO
ONR:403M:RJM:rj
9 June 1966

Mr. Frank Speight
Director, Information Program
Engineers Joint Council
345 East 47th Street
New York, New York 10017

Dear Mr. Speight:

Reference is made to your letter of June 3, 1966 to Mr. J. Heston Heald, Director of Project LEX, in which you set forth certain agreements as an understanding in the joint thesaurus efforts.

It is realized that it would be difficult to evaluate these trade-off arrangements in exact dollars. However, it would appear that the costs are small in comparison to the overall efforts and that, in reality, they are far overshadowed by the resultant payoff of the joint arrangements. Hence, this Office concurs.

Sincerely,

/s/ Robert J. Mindak
ROBERT J. MINDAK
Project Officer
Project LEX

Copy to:
ONR (Mr. Buchanan)
ONR (Code 403M)
Project LEX

Appendix 4

INFORMATION SYSTEMS PROGRAM

ENGINEERS JOINT COUNCIL

345 EAST 47TH STREET, NEW YORK, N. Y. [illegible]
(212) PL 3-0990 • CABLE - ENGUNITY

November 28, 1966

Mr. Heston Heald
Director, Project LEX
Office of Naval Research
Navy Department
Washington, D. C.

Dear Mr. Heald:

I want to confirm the several conversation we have had with yourself, Mr. Spence and your staffs regarding the publication of the Thesaurus (please refer to my letter dated July 26, 1966). Both the Engineers Joint Council Vocabulary Panel and Mr. Speight of the EJC staff are recommending that the full Thesaurus be published by Engineers Joint Council and be made available to the public through EJC. This we are planning to do although its exact form has not been resolved.

We would like to have your written confirmation of the following points:

a) The Department of Defense will publish approximately 10,000 copies of the Thesaurus through the Government Printing Office which will be restricted to distribution within the Department of Defense and Department of Defense interests as defined by those authorized to use the Defense Documentation Center.

b) We would want to have the usual EJC copyright notice printed on the title page of the publication. At our last meeting I got the impression that there may be a directive which might bear on how such a statement must be phrased. If so, please let me know which regulation is involved and what the revised wording might be.

c) The publication will not be made available for distribution beyond that indicated above except through Engineers Joint Council.

d) Permission to publish will not be granted to any other group.

e) Camera-ready copy and a complete copy of the Thesaurus on magnetic tape be given to Engineers Joint Council as agreed to in previous correspondence.

I would appreciate you securing the appropriate concurrences.

Sincerely,

(signed)
Carl Frey

CF/mf
cc: N. Cottrell
C. Linder
F. Speight

Appendix 4

DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH
WASHINGTON, D. C. 20360

IN REPLY REFER TO
LEX:JHH:cab
12 January 1967

Mr. Carl Frey
Secretary
Engineers Joint Council
345 E. 47th Street
New York, New York 10017

Dear Mr. Frey:

This is in reply to your letter of November 28, 1966 to the Director of Project LEX regarding plans of the Engineers Joint Council to publish the full Thesaurus and make it available to the public. For clarification, we understand this to mean that EJC now plans to print and sell the entire DoD-wide Thesaurus in lieu of the selected engineering portions as was originally planned.

Such a plan is strongly encouraged. Hence, the following procedures and arrangements are offered. They are in accordance with existing Government policies and regulations. It is believed that, although they represent some modification to the points stated in your letter, the principal factors are covered and confirmed.

1. An overriding policy which affects all points of concern here is the fundamental policy of the Department of Defense to make maximum information available to the public. Hence, unclassified and unlimited documents it prepares must have an outlet. If EJC provided this outlet, the version it prints must have substantial likeness to the DoD version and have approval of the Director of Project LEX. It is believed that agreements in this direction have generally been reached; however. any substantial deviation would serve to negate the plan.

2. There are at least two prime factors which bear on points mentioned in the EJC letter.

a. Section 8 of Title 17, U.S. Code, provides that copyright cannot subsist in Government publications. It does provide that "The publication or republication by the Government, either separately or in a public document, of any material in which copyright is subsisting shall not be taken to cause any abridgement or annulment of the copyright or to authorize any use or appropriation of such copyright material without the consent of the copyright proprietor."

b. As a DoD document the Thesaurus is subject to the distribution provisions of DoD Directive 5200.20, dated March 29, 1965. Distribution Statement No. 1, "Distribution of this Document is Unlimited" is applicable since the Thesaurus will contain no classified or limited type of information.

3. In consideration of the first factor, discussions were held with Mr. George Cary, Deputy Register of Copyrights. It was pointed out that the first edition of Thesaurus of Engineering Terms was copyrighted by EJC in 1964 and that most of the terms therein would be interspersed throughout the present DoD Thesaurus as a combined work and, for EJC, as a revision of the first edition. The following notation for each entry was determined appropriate:

a. In the EJC printing -

On title page or verso of title page:

"© 1964 and 1967 by Engineers Joint Council. Portions of the earlier version under the title Thesaurus of Engineering Terms are included in this revised work prepared in conjunction with the U. S. Department of Defense."

b. In the Government printing -

On the title page or verso of title page:

"Portions of this work were previously copyrighted by EJC under the title Thesaurus of Engineering Terms, 1964. In accordance with the provisions of Section 8, Title 17, U. S. Code, this issuance shall not be taken as c use for annulment of the copyright."

It is believed that the above markings in each printing would preclude publication by any group outside EJC and the Government without prior permission of EJC.

4. As for the second factor, it would not be in the best public interest to place any kind of distribution limitation on the DoD Thesaurus. It is believed, however, that DoD can, and in fact must, confine the "give-away" copies to the legitimate users of DDC as provided for in DoD Instruction 5100.38, Paragraph VII, which reads in

part:

> "A. Unclassified Services. To all U.S. Government agencies (Executive, Legislative and Judicial Branches), their contractors and grantees, including DoD potential contractors, upon satisfactory evidence to DDC of such affiliation."

In addition, ONR plans to provide complimentary copies to those who participated in the panel sessions and possibly a few others who have in some way contributed to the joint EJC-Project LEX effort. The total Government run for all of the purposes in this paragraph will probably be on the order of 10,000 copies. Each is to carry the statement "Distribution of this Document is Unlimited." Such a statement is not necessary on the EJC copies since they would carry the copyright notice.

5. Another matter concerns the Clearinghouse for Federal Scientific and Technical Information (CFSTI) which normally makes all unlimited documents available to the public. CFSTI has agreed to announce the Thesaurus in U.S. Government Research and Development Reports indicating availability through EJC. CFSTI would offer microfiche copy but sale potential in this form is considered negligible.

6. Copies of the Thesaurus necessary to fill the requirements indicated in item 4 above, will be printed within the Government.

If you are in agreement with the above points camera-ready copy and a complete magnetic tape copy will be given to EJC and the Superintendent of Documents, Government Printing Office, will be requested not to put the publication on sale.

Sincerely,

/s/ J. K. Leydon
J. K. LEYDON
Rear Admiral, USN
Chief of Naval Research

APPENDIX 5

(Verso Blank)

Appendix 5

DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH
WASHINGTON, D. C. 20360

IN REPLY REFER TO
LEX:JHH:mlf

17 [illegible] 1967

MEMORANDUM FOR THE DIRECTOR OF TECHNICAL INFORMATION, OSD, DDR&E
Attn: Mr. Walter C. Christensen

Subj: Recommendations concerning the COSATI Subject Category List.

Ref: (a) DDR&E Memorandum of 12 October 1965, Subj: DoD-Wide Technical Thesaurus

Encl: (1) Specific recommendations and comments
(2) Fields and groups as used by Project LEX
(3) COSATI Subject Category List, 1st Edition, December 1964

1. This memorandum is submitted in fulfillment of one of the missions of Project LEX, as set forth in reference (a), which was to make recommendation for any changes in the COSATI Subject Category List, (SCL), 1st Edition, December 1964, that might become apparent during the course of the work.

2. Enclosure (1) lists the specific recommendations and comments. It is divided into two sections, A and B. Section A represents the actual changes made by Project LEX and Section B lists fields and groups which were used by the Project but which might be improved by the changes indicated. Enclosure (2) is a complete list of the subject fields and groups as they will appear in the Thesaurus of Engineering and Scientific Terms, (TEST). An asterisk appears at each point where a field or group differs from the present SCL. Enclosure (3) is provided for immediate reference.

3. During the course of the Project, almost 350 scientists, engineers, lexicographers, and library subject specialists participated in reviewing the interdisciplinary collection of over 145,000 separate terms. Their decisions have resulted in establishing some 18,000 descriptors and another 5,000 "USE" references as entries in TEST. SCL was used as a means of displaying and grouping the descriptors. Each descriptor was assigned to one or more of the subject fields and groups. A Subject Category Index will appear as one of the divisions of TEST to provide this display.

4. Although the categorization afforded by the COSATI SCL was generally applicable for displaying the TEST vocabulary, adjustments were required in several instances to develop a more useful display. These adjustments

included the addition and deletion of several groups, the renaming of some groups and fields, and the revision or permissive interpretation of some scope notes. In addition, a numeric field and group code was substituted for the alpha-numeric code. It will be noted that all 22 fields in the SCL were used with no material change. Two were changed slightly in name form only.

5. It is recommended that the changes and comments in Enclosure (1) be forwarded to COSATI for consideration in a revision of SCL.

B. C. [illegible]
Capt[illegible]
Chief of [illegible] Research (Acting)

Appendix 5

Changes made
in
COSATI Subject Category List

These changes were made by Project LEX in building the Thesaurus of Engineering and Scientific Terms (TEST). The four-digit numerical code for the fields and groups was also used in TEST and considered preferable to the numerical-alpha coding in the COSATI List. The numerical code used in TEST is shown first, followed in parenthesis by the COSATI numerical-alpha code. Adoption of the four-digit number is recommended as well as all other changes shown below.

The fields appear in caps while all groups are underscored.

01 AERONAUTICS

01 01 (01 A) Aerodynamics
This group was deleted in TEST because any terms listed here would also appear in the group Fluid dynamics.

01 04 (01 A) Aircraft flight control and instrumentation
Group name changed to Aircraft flight instrumentation because flight control was considered to be included more properly in the group Aircraft.

05 BEHAVIORAL AND SOCIAL SCIENCES

05 02 (05 B) Documentation and information technology
Group name changed to Information sciences. Panelists at Project LEX favored this change. (American Documentation Institute is now considering changing its name to include this broader phrase.)

05 08 (05 H) Man-machine systems
This group was deleted. The scope is not clear, but the concepts named appear to be covered in the group Human factors engineering.

05 10 (05 J) Psychology (Individual and group behavior)
Group name changed to Psychology. The parenthetic phrase served no purpose in LEX deliberations, hence it is felt to be unnecessary.

06 BIOLOGICAL AND MEDICAL SCIENCES

06 10 (06 J) Industrial (occupational) medicine
This group was not used in TEST. The concepts mentioned in the scope note are covered adequately in the other groups in 06.

06 12 (06 L) Medical and hospital equipment and supplies
Group named changed to Medical equipment and supplies. Terms used by TEST for hospital equipment and supplies of a non-medical nature were appropriately placed in some other group such as 14 03, 14 05, 13 01, etc.

07 CHEMISTRY

07 04 (07 D) Physical Chemistry
Group name changed to Physical and general chemistry. The group was considered to include all chemical concepts that could not be assigned to another group.

08 EARTH SCIENCES AND OCEANOGRAPHY

08 14 (08 N) Terrestrial magnetism
Group name changed to Geomagnetism to reflect common usage.

10 ENERGY CONVERSION (Non-propulsive)
Field name changed to NONPROPULSIVE ENERGY CONVERSION to be consistent with the TEST term format of direct entry and without hyphens whenever possible.

11 MATERIALS

11 06 (11 F) Metallurgy and Metallography
Group name changed to Metals which seems to properly indicate the scope.

11 13 A group entitled Corrosion and degradation, 11 13, was added to this field to accommodate these concepts.

13 MECHANICAL, INDUSTRIAL, CIVIL, AND MARINE ENGINEERING

13 09 (13 I) Machinery and tools
Group renamed Machinery, tools, and industrial equipment in order to accommodate terms representing equipment other than machinery and tools

14 METHODS AND EQUIPMENT

14 06 Research fields
Added to accommodate terms that could not be assigned logically to any other group.

14 07 General concepts
See 14 06.

14 08 A DDC added group. Not used in TEST because all terms placed in other groups - primarily 14 07.

14 09 Geometric forms
See 14 06.

15 MILITARY SCIENCES

15 02 (15 B) Chemical, biological, and radiological warfare
Group name changed to Chemical, biological, and radiological operations to correspond to preferred military usage.

17 NAVIGATION, COMMUNICATIONS, DETECTION, AND COUNTERMEASURES

17 11 Miscellaneous detection
Added to accommodate terms representing concepts that could not be assigned to any existing group.

18 NUCLEAR SCIENCE AND TECHNOLOGY

18 01 (18 A) Fusion devices (Thermonuclear)
This group was deleted. The concept was covered adequately by the group Plasma Physics, 20 09 (20 I).

18 05 (18 E) Nuclear powerplants
This group was deleted. The concept was considered to fall within the scope of the groups Electronic and electrical engineering, 09 03 (09 C), and Power sources, 10 02 (10 B).

18 09 (18 I) Reactor engineering and operation
Group name changed to Reactor technology. This group was

considered to include the concepts represented by Reactors(Power), 18 12 (18 L), and Reactors(Non-power), 18 13 (18 M), which are more specific than required.

18 12 (18 L) Reactors (Power)
Deleted. See above.

18 13 (18 M) Reactors (Non-power)
Deleted. See above.

18 14 (18 N) SNAP technology
This group was deleted. The concept was considered to be included in the group Power sources, 10 02 (10 B).

19 ORDNANCE

19 01 (19 A) Ammunition, explosives
This group name was changed to Ammunition, explosives, and pyrotechnics to more clearly indicate the coverage.

20 PHYSICS

20 08 (20 H) Particle physics
Group name changed to Particle physics and nuclear reactions in order to represent compatibility with the scope note.

20 10 (20 J) Quantum theory
Group name changed to Quantum theory and relativity - again to better represent the scope note.

20 11 (20 K) Solid mechanics
Group name changed to Mechanics. This group was considered to encompass all terms relating to mechanics except those that deal specifically with fluid mechanics.

21 PROPULSION AND FUELS
Field name changed to PROPULSION, ENGINES, AND FUELS to accommodate added groups below.

21 01 (21 A) Air-breathing engines
This group was deleted. There were no terms in TEST that could not be assigned to a more specific engine group.

21 08 (21 H) Rocket motors and engines
Group name changed to Rocket engines to confirm to TEST usage.

21 10 Engine components
Added to accommodate terms that could not be assigned to other groups.

21 11 General engine concepts
See 21 10.

21 12 General propulsion concepts
See 21 10.

Appendix 5

Comments submitted by Project LEX
for consideration in a revision
of
COSATI Subject Category List

01 AERONAUTICS

01 02 (01 B) Aeronautics
This group is used in TEST, however a name change should be considered, since the field has the same name. Suggest Aircraft operations. Group 01 03 (01 C) might then be called Aircraft production and control for clarity.

02 AGRICULTURE

02 01 (02 A) Agricultural chemistry
Interpreted as including applications of chemistry in the production of agricultural products. Suggest the scope note be worded to include this interpretation.

06 BIOLOGICAL AND MEDICAL SCIENCES

06 03 (06 C) Biology
This group was used in TEST, but it is a large and heterogeneous one. Consideration should be given to establishing separate groups in zoology and botany. Terms that could apply in both human and animal physiology and anatomy were listed only in the group Physiology.

06 13 (06 M) Microbiology
The scope note is too restrictive; recommend it be rewritten to include all microscopic life forms. TEST used this interpretation.

06 18 (06 R) Radiobiology
This group was used in TEST, although it is believed that the scope note could be improved to distinguish more clearly between the coverage here and that of the groups, Chemical, biological, and radiological warfare, 15 02 (15 B) and Radioactivity, 18 08 (18 H).

06 20 (06 T) Toxicology
Coverage of this group appears to overlap that of the groups Clinical medicine, 06 05 (06 E), Environmental biology, 06 06 (06 F), and Safety engineering 13 12 (13 L). Suggest scope note clarification of all four groups involved.

(Enclosure 1B)

08 EARTH SCIENCES AND OCEANOGRAPHY

08 07 (08 G) Geology and mineralogy
This group was interpreted as including the classification of soils. Recommend scope note be reworded accordingly.

08 09 (08 I) Mining engineering
This group was interpreted as including oil and gas production as well as all types of prospecting. Recommend scope note be reworded accordingly.

08 13 (08 M) Soil mechanics
This group was used in TEST, although there appears to be overlap with the group Snow, ice, and permafrost, 08 12 (08 L). Consideration should be given to clarifying both scope notes.

09 ELECTRONICS AND ELECTRICAL ENGINEERING
An attempt was made to utilize the groups and their scope notes in TEST, but considerable doubt remains that the arrangement is as good as it could be. Further study of the entire field is suggested.

09 01 (09 A) Components
At a minimum, the group name should be made more explicit. The word alone could be used in many areas.

09 02 (09 B) Computers
It seems illogical to include computer software in an electronics field. Consideration should be given to a new group for computer software, possibly under MATHEMATICAL SCIENCES(12).

09 04 (09 D) Information theory
This group appears to be misplaced. It was used here by Project LEX but it is believed that this entire group can be more logically accommodated under Information sciences, 05 02 (05 B), and it is so recommended.

09 05 (09 E) Subsystems
As in 09 01, the name should be more explicit.

13 MECHANICAL, INDUSTRIAL, CIVIL, AND MARINE ENGINEERING

13 07 (13 G) Hydraulic and pneumatic equipment
This group was interpreted as including turbomachinery and fluidic devices and a scope note change to this effect is recommended.

13 13 (13 M) Structural engineering
This group was used in TEST, although there appears to be overlap with the group Civil engineering, 13 02 (13 B). Scope notes for both groups might be improved to provide clarification.

14 METHODS AND EQUIPMENT
This field name was used in TEST, but consideration should be given to adopting METHODOLOGY as the title since this more explicitly indicates the concepts of the field.

14 02 (14 B) Laboratories, test facilities, and test equipment
This group was interpreted as including a wide variety of instruments and tests. Recommend revision of the scope note accordingly.

15 MILITARY SCIENCES

15 05 (15 E) Logistics
This group was interpreted as including all general transportation. Some better arrangements should be made for categorizing civilian transportation concepts.

15 06 (15 F) Nuclear warfare
The coverage of this group appears to overlap that of the groups Radiobiology, 06 03 (06 C), and Nuclear explosions, 18 03 (18 C). This might be clarified by rewording the scope notes to include only military operational aspects under 15 06 and by changing the name to Nuclear operations.

20 PHYSICS

20 06 (20 F) Optics
This group considered to encompass theoretical optics. Terms representing equipment and instruments were considered to be within the scope of the group Laboratories, test facilities, and test equipment, 14 02 (14 B). A scope note change is suggested.

20 14 (20 N) Wave propagation
Radiofrequency spectroscopy was considered to be within the scope of the group Laboratories, test facilities, and test equipment, 14 02 (14 B). Scope note change is suggested.

Appendix 5

SUBJECT CATEGORY FIELDS AND GROUPS

01 AERONAUTICS
- *01 01
- 01 02 Aeronautics
- 01 03 Aircraft
- 01 04 Aircraft flight instrumentation
- 01 05 Air facilities

02 AGRICULTURE
- 02 01 Agricultural chemistry
- 02 02 Agricultural economics
- 02 03 Agricultural engineering
- 02 04 Agronomy and horticulture
- 02 05 Animal husbandry
- 02 06 Forestry

03 ASTRONOMY AND ASTROPHYSICS
- 03 01 Astronomy
- 03 02 Astrophysics
- 03 03 Celestial mechanics

04 ATMOSPHERIC SCIENCES
- 04 01 Atmospheric physics
- 04 02 Meteorology

05 BEHAVIORAL AND SOCIAL SCIENCES
- 05 01 Administration and management
- *05 02 Information sciences
- 05 03 Economics
- 05 04 History, law, and political science
- 05 05 Human factors engineering
- 05 06 Humanities
- 05 07 Linguistics
- *05 08
- 05 09 Personnel selection, training, and evaluation
- *05 10 Psychology
- 05 11 Sociology

06 BIOLOGICAL AND MEDICAL SCIENCES
- 06 01 Biochemistry
- 06 02 Bioengineering
- 06 03 Biology
- 06 04 Bionics
- 06 05 Clinical medicine
- 06 06 Environmental biology
- 06 07 Escape, rescue, and survival

06 08 Food
06 09 Hygiene and sanitation
*06 10
06 11 Life support
*06 12 Medical equipment and supplies
06 13 Microbiology
06 14 Personnel selection and maintenance (medical)
06 15 Pharmacology
06 16 Physiology
06 17 Protective equipment
06 18 Radiobiology
06 19 Stress physiology
06 20 Toxicology
06 21 Weapon effects

07 CHEMISTRY
07 01 Chemical engineering
07 02 Inorganic chemistry
07 03 Organic chemistry
*07 04 Physical and general chemistry
07 05 Radio and radiation chemistry

08 EARTH SCIENCES AND OCEANOGRAPHY
08 01 Biological oceanography
08 02 Cartography
08 03 Dynamic oceanography
08 04 Geochemistry
08 05 Geodesy
08 06 Geography
08 07 Geology and mineralogy
08 08 Hydrology and limnology
08 09 Mining engineering
08 10 Physical oceanography
08 11 Seismology
08 12 Snow, ice, and permafrost
08 13 Soil mechanics
*08 14 Geomagnetism

09 ELECTRONICS AND ELECTRICAL ENGINEERING
09 01 Components
09 02 Computers
09 03 Electronic and electrical engineering
09 04 Information theory
09 05 Subsystems
09 06 Telemetry

10 NONPROPULSIVE ENERGY CONVERSION
- 10 01 Conversion techniques
- 10 02 Power sources
- 10 03 Energy storage

11 MATERIALS
- 11 01 Adhesives and seals
- 11 02 Ceramics, refractories, and glasses
- 11 03 Coatings, colorants, and finishes
- 11 04 Composite materials
- 11 05 Fibers and textiles
- *11 06 Metals
- 11 07 Miscellaneous materials
- 11 08 Oils, lubricants, and hydraulic fluids
- 11 09 Plastics
- 11 10 Rubbers
- 11 11 Solvents, cleaners, and abrasives
- 11 12 Wood and paper products
- *11 13 Corrosion and degradation

12 MATHEMATICAL SCIENCES
- 12 01 Mathematics and statistics
- 12 02 Operations research

13 MECHANICAL, INDUSTRIAL, CIVIL, AND MARINE ENGINEERING
- 13 01 Air conditioning, heating, lighting, and ventilating
- 13 02 Civil engineering
- 13 03 Construction equipment, materials, and supplies
- 13 04 Containers and packaging
- 13 05 Couplings, fasteners, and joints
- 13 06 Ground transportation equipment
- 13 07 Hydraulic and pneumatic equipment
- 13 08 Industrial processes
- *13 09 Machinery, tools, and industrial equipment
- 13 10 Marine engineering
- 13 11 Pumps, filters, pipes, tubing, and valves
- 13 12 Safety engineering
- 13 13 Structural engineering

14 METHODS AND EQUIPMENT
- 14 01 Cost effectiveness
- 14 02 Laboratories, test facilities, and test equipment
- 14 03 Recording devices
- 14 04 Reliability
- 14 05 Reprography
- *14 06 Research

*14 07 General concepts
*14 08
*14 09 Geometric forms

15 MILITARY SCIENCES
15 01 Antisubmarine warfare
*15 02 Chemical, biological, and radiological operations
15 03 Defense
15 04 Intelligence
15 05 Logistics
15 06 Nuclear warfare
15 07 Operations, strategy, and tactics

16 MISSILE TECHNOLOGY
16 01 Missile launching and ground support
16 02 Missile trajectories
16 03 Missile warheads and fuzes
16 04 Missiles

17 NAVIGATION, COMMUNICATIONS, DETECTION, AND COUNTERMEASURES
17 01 Acoustic detection
17 02 Communications
17 03 Direction finding
17 04 Electromagnetic and acoustic countermeasures
17 05 Infrared and ultraviolet detection
17 06 Magnetic detection
17 07 Navigation and guidance
17 08 Optical detection
17 09 Radar detection
17 10 Seismic detection
*17 11 Miscellaneous detection

18 NUCLEAR SCIENCE AND TECHNOLOGY
*18 01
18 02 Isotopes
18 03 Nuclear explosions
18 04 Nuclear instrumentation
*18 05
18 06 Radiation shielding and protection
18 07 Radioactive wastes and fission products
18 08 Radioactivity
*18 09 Reactor technology
18 10 Reactor materials
18 11 Reactor physics
*18 12
*18 13
*18 14

19 ORDNANCE
- *19 01 Ammunition, explosives, and pyrotechnics
- 19 02 Bombs
- 19 03 Combat vehicles
- 19 04 Explosions, ballistics, and armor
- 19 05 Fire control and bombing systems
- 19 06 Guns
- 19 07 Rockets
- 19 08 Underwater ordnance

20 PHYSICS
- 20 01 Acoustics
- 20 02 Crystallography
- 20 03 Electricity and magnetism
- 20 04 Fluid mechanics
- 20 05 Masers and lasers
- 20 06 Optics
- 20 07 Particle accelerators
- *20 08 Particle physics and nuclear reactions
- 20 09 Plasma physics
- *20 10 Quantum theory and relativity
- *20 11 Mechanics
- 20 12 Solid state physics
- 20 13 Thermodynamics
- 20 14 Wave propagation

*21 PROPULSION, ENGINES, AND FUELS
- *21 01
- 21 02 Combustion and ignition
- 21 03 Electric propulsion
- 21 04 Fuels
- 21 05 Jet and gas turbine engines
- 21 06 Nuclear propulsion
- 21 07 Reciprocating engines
- *21 08 Rocket engines
- 21 09 Rocket propellants
- *21 10 Engine components
- *21 11 General engine concepts
- *21 12 General propulsion concepts

22 SPACE TECHNOLOGY
- 22 01 Astronautics
- 22 02 Spacecraft
- 22 03 Spacecraft trajectories and reentry
- 22 04 Spacecraft launch vehicles and ground support

* Indicates where changes were made to the present COSATI Subject Category List.

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APPENDIX 6

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BIBLIOGRAPHY OF REFERENCE MATERIAL USED BY PROJECT LEX

*Indicates those term lists which were merged by computer to form the working data bank. The two-letter abbreviation is the code used on the magnetic tape to identify the source.

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*(CX)Advanced Research Projects Agency.
TERM LIST

Aero Publishing, Inc.
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*(AX)Aerospace Corporation.
A RETRIEVAL SYSTEM FOR SEARCHING DEFENSE DOCUMENTATION CENTER MAGNETIC TAPE FILE, October 1963 (Report No. ATN-63-(9990)-5)

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Air Force Flight Test Center, Edwards AFB, California.
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*(ML) Air Force Materials Laboratory, Wright-Patterson AFB, Ohio.
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*(AE)Air Force Systems Command, Brooks AFB, Aerospace Medical Division.
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*(VO)Aktiebolaget Volvo, Goteborg, Sweden.
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*(CS)American Ceramic Society.
LISTING OF TERMS

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CHEMICAL ABSTRACTS, Volume 62
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THE RING INDEX, 2nd Edition with Supplements I, II, and III

*(CI)American Concrete Institute.
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*(IE)American Institute of Industrial Engineers.
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*(IP)American Institute of Physics.
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*(AP)American Petroleum Institute.
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INDEXER'S MANUAL
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*(JZ)American Psychological Association.
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*(AS)American Society for Engineering Education.
LISTING OF TERMS
*(SM)American Society for Metals.
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ASM THESAURUS
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ASHRE GUIDE AND DATA BANK, 1963, FUNDAMENTALS AND EQUIPMENT
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Appendix 6

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*(AL)Amphenol Corporation.
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*(AB)Army Biological Laboratories, Ft. Detrick, Maryland.
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*(DC)Army Combat Developments Command, Ft. McClellan, Alabama.
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*(AW)Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.
PERFORMANCE OF SOILS UNDER TIRE LOADS, Report 1, Technical Report No. 3-666, January 1965
SUBJECT HEADING LIST (Revised), 7 March 1957

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*(LM)Army Logistics Management Center, Ft. Lee, Virginia.
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*(MV)Army Material Command.
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*(MR)Army Materials Research Agency, Watertown, Massachusetts.
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*(MO)Monsanto Company.
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*(NA)National Aeronautics and Space Administration.
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NASA SSDC THESAURUS
THE SPACE ENVIRONMENT

*(DA)National Agricultural Library.
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BIBLIOGRAPHY OF AGRICULTURE, Volume 29, Number 12, December 1965
SUBJECT HEADING LIST, PRELIMINARY EDITION, Volumes I - IV, June 1963
LISTING OF TERMS

*(CO)National Association of Corrosion Engineers.
TERMS SELECTED FROM INDEX TO CORROSION ABSTRACTS

*(BM)National Broach and Machine Company.
LISTING OF TERMS

National Cancer Institute.
SUBJECT-AUTHOR INDEX, CARCINOGENESIS ABSTRACTS, Volume I, 1963-1964

National Cash Register Company, Electronics Division.
PCMI TECHNOLOGY AND POTENTIAL APPLICATIONS

*(AZ)National Center for Atmospheric Research, Boulder, Colorado.
LISTING OF TERMS

*(FP)National Fire Protection Association.
LISTING OF TERMS

National Fluid Power Association.
GLOSSARY OF TERMS FOR FLUID POWER, B93.2 - 1965

*(IH)National Institute of Health, Division of Research Grants.
LISTING OF TERMS
MEDICAL AND HEALTH RELATED SCIENCES THESAURUS (Public Health Service Publication No. 1031), March 1963

*(MZ)National Library of Medicine.
MEDICAL SUBJECT HEADINGS (MESH)

*(OC)National Oceanographic Data Center.
NATIONAL OCEANOGRAPHIC DATA CENTER THESAURUS

*(DX)National Oceanographic Data Center.
THE SAURUS (Subject Index and Scope Note Index)
ALPHABETICAL LISTING OF DESCRIPTORS
ACRONYMS AND ABBREVIATIONS RELATED TO OCEANOGRAPHY
NODC QUARTERLY ACCESSIONS, Computer Produced Indexes, Volume I, Number 1, April 1966

National Printing Ink Research Institute.
PRINTING INK HANDBOOK
National Research Council, Highway Research Board.
GLOSSARY OF PEDOLOGIC (SOILS) AND LANDFORM TERMINOLOGY FOR SOIL ENGINEERS, Special Report 25, 1957
National Research Council of Canada, National Sciences Library.
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*(NS)National Safety Council.
LISTING OF TERMS
National Society for the Prevention of Blindness, Incorporated.
VOCABULARY OF TERMS RELATING TO THE EYE, Publication P-607, 1964
*(AH)Naval Amphibious Schools.
AMPHIBIOUS TERMINOLOGY AND COMMON AMPHIBIOUS ABBREVIATIONS
*(CL)Naval Civil Engineering Laboratory.
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Naval Facilities Engineering Command.
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Naval Ordnance Laboratory, Corona, California.
STATISTICS LIST
*(NO)Naval Ordnance Laboratory, White Oak, Maryland.
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*(CZ)Naval Ordnance Test Station, Inyokern, California.
MAGNETIC TAPE OF DESCRIPTORS USED BY NOTS TECHNICAL LIBRARY
DESCRIPTOR INDEX
*(NP)Naval Postgraduate School, Monterey, California.
LISTING OF TERMS
*(CV)Naval Research Laboratory, Shock and Vibration Information Center.
TECHNICAL TERMINOLOGY USED BY THE SHOCK AND VIBRATION INFORMATION CENTER
ILLUSTRATED GLOSSARY OF FRACTOGRAPHIC TERMS, Section II, NRL Memo Report 1547, June 1964
*(BS)Naval Ship Research and Development Center.
NARDIS THESAURUS, January 1966
NARDIS THESAURUS CODE BOOK, January 1966
Naval Ship Systems Command.
PROJECT SHARP (SHIPS ANALYSIS AND RETRIEVAL PROJECT) INFORMATION STORAGE AND RETRIEVAL SYSTEM: COMPUTER ASPECTS AND PROGRAMS, December 1964
THESAURUS OF DESCRIPTIVE TERMS AND CODE BOOK, 2nd Edition, March 1965
*(BA)Naval Supply Systems Command.
LISTING OF TERMS
LOGISTICS GLOSSARY (NavSandA Publication 93), 1 December 1948
LOGISTICS SUBJECT HEADINGS
SUBJECT HEADING GUIDE FOR MILITARY PACKAGING, 21 January 1953

*(DY)Naval Training Device Center, Port Washington, New York.
USN TRAINING DEVICE CENTER KROS TERM READY REFERENCE ENGINEERING DATA, Volumes I and II, Abstracts, Volume I of Index
*(WL)Naval Weapons Laboratory.
PHASE II, EMPIRE INFORMATION SYSTEM, Final Technical Report, Contract N178-8596, 21 January 1966
THESAURUS OF EMPIRE (Electromagnetic Phenomena Interference Repository) DESCRIPTORS, Revised, Volumes I and II, 6 January 1966
NAVAL WEAPONS LABORATORY TECHNICAL LIBRARY THESAURUS
*(NE)Navy Electronics Laboratory, San Diego, California.
ICE GLOSSARY, 10 June 1965
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NAVIGATION DICTIONARY, H.O. Publication 220, 1963 Reprint
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Netherlands Armed Forces Document and Information Centre.
TDCK - CIRCULAR THESAURUS SYSTEM, 1st Edition, May 1963
*(NY)New York City Department of Public Works, Water Pollution.
LISTING OF TERMS
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GLOSSARY - COMPUTER TERMINOLOGY CONVERSION TABLES
MICROMINATURE CIRCUITRY GLOSSARY TERMS AND DEFINITIONS, December 1962
*(NN)Northrop Norair.
SUBJECT AUTHORITY LIST FOR REPORT CATALOGING, Norair Technical Library, February 1966
*(NC)Norton Company, Gould Eberhardt Division.
LISTING OF TERMS
*(OA)Office of Aerospace Research.
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*(NR)Office of Naval Research.
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KEY WORD LIST, GROUP DESCRIPTOR - DESCRIPTOR FIEID RELATED TO THE MECHANICAL WORKING GROUP'S AREA OF INTEREST
*(HB)Office of Naval Research, Hibernation Information Exchange, Chicago, Illinois.
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NAVY-MARINE CORPS STANDARD SUBJECT CLASSIFICATION SYSTEM, SecNav P5210.11, 30 October 1959
*(WR)Office of Water Resources Research.
WATER RESOURCES THESAURUS, November 1966
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Pender, Del Mar, and Pender, McIllwan.
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Pennsylvania State University, Organic Sediments Laboratory.
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Pennsylvania State University, University Division of Instructional Services.
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Permagon Press.
REPORT OF THE COMMISSION ON ENZYMES, Volume 20
*(PR)Personnel Research Laboratory, Aerospace Medical Division, Lackland AFB, Texas.
PERSONNEL RESEARCH LABORATORY DICTIONARY, 1965
*(PH)Philco Corporation, Aeronutronic Division.
LIST OF NEW DESCRIPTORS ADDED TO THE DDC THESAURUS
*(PT)Plastics Technical Evaluation Center.
PLASTEC DOCUMENT INDEX, Volume I, Number 7, August 1965
*(PD)Prevention of Deterioration Center, National Academy of Sciences, National Research Council.
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HOW THE UNITED STATES LOOKS AT THE AUTO EXHAUST PROBLEM
LIST OF GENERAL RESEARCH AREAS AND MEDICAL RELATED SCIENCES THESAURUS, October 1965
MOTOR VEHICLES, AIR POLLUTION AND HEALTH, June 1962
*(PP)Pulp and Paper Research Institute of Canada.
THESAURUS OF PULP AND PAPER TERMS, 1st Edition, March 1965
Radio Corporation of America, DATA Systems Division.
DISASSEMBLY BREAKDOWN
DEFINITIONS, October 1962
*(RS)Redstone Scientific Information Center.
RSIC UNCLASSIFIED AUTHORITY LIST FOR INDEXING TECHNICAL REPORTS (Supplementary to Thesaurus of ASTIA Descriptors, 2nd Edition, and ASTIA Subject Headings, 4th Edition)
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Research Studies Institute, Air University.
AEROSPACE GLOSSARY, September 1959
*(RT)Research Triangle Institute.
A THESAURUS OF CIVIL DEFENSE DESCRIPTORS, (RTI N . OU-158-1), January 1965
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*(BT)Rutgers University, School of Pharmacy.
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Society of American Foresters.
FORESTRY TERMINOLOGY, A GLOSSARY OF TECHNICAL TERMS USED IN FORESTRY, 3rd Edition, Revised, 1964
*(SA)Society of Automotive Engineers.
1966 SAE HANDBOOK
LISTING OF TERMS
*(SP)Society of Photographic Scientists and Engineers.
SOCIETY OF PHOTOGRAPHIC SCIENTISTS AND ENGINEERS THESAURUS
Stanier, Doudoroff, and Adelberg.
THE MICROBIAL WORLD
Strategic Air Command.
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CRDL DICTIONARY, Volume I, May 1963
Traffic Service Corporation.
A GLOSSARY OF TRAFFIC TERMS AND ABBREVIATIONS, 1945
Trilon Research Corporation.
GUIDED MISSILE GLOSSARY OF TERMINOLOGY (Preliminary Draft)
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TRW Space Technology Laboratories.
TYPES OF STANDARDS, 3 September 1964
TRW Systems.
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*(HV)United Aircraft Corporation.
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United States Pharmacopeia.
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LIST OF U.S.P. PHARMACOLOGIC CATEGORY DESIGNATIONS WITH EXAMPLES OF CORRESPONDING THERAPEUTIC AGENTS
*(UI)University of Illinois, Civil Engineer Department.
LISTING OF TERMS
University of Tulsa, Information Services Department.
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Urquhart, Leonard C.
CIVIL ENGINEERING HANDBOOK, 4th Edition
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AMERICAN STANDARD NOMENCLATURE FOR: STEEL DOORS AND STEEL DOOR FRAMES; MOTION PICTURE FILM; THE FIELD OF COLORIMETRY; MOLDED GLASS FLARES; GLASS BULBS; BEDDING AND UPHOLSTERY; WIRE AND CABLE; REFRIGERATION; BALANCE ROTATING MACHINERY; RADIOMETRY AND PHOTOMETRY; ACOUSTICAL TERMINOLOGY; SINGLE POINT TOOLS AND TOOL POSTS; AC HIGH-VOLTAGE CIRCUIT BREAKERS; and MEASUREMENT ANI DEFINITION OF THE PIEZOELECTRIC VIBRATOR
DIMENSIONS, TOLERANCES, AND TERMINOLOGY FOR HOME COOKING AND BAKING UTENSILS
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INTERNATIONAL DICTIONARY OF PHYSICS AND ELECTRONICS, New Second Edition
MATHEMATICS DICTIONARY, Multilingual Edition
PRINCIPLES OF GUIDED MISSILE DESIGN, DICTIONARY OF GUIDED MISSILES AND SPACE FLIGHT
THE INTERNATIONAL DICTIONARY OF APPLIED MATHEMATICS
SCIENTIFIC ENCYCLOPEDIA, 3rd Edition, 1958
*(BV)Veterans Administration, Department of Medicine and Surgery.
KEYWORDS
GLOSSARY FOR PROSTHETISTS
Virginia University.
SCIENCE TECHNOLOGY SUBJECT HEADING LISTS IN ENGLISH, RECENT OR STILL USEFUL IN PROGRAMMING INFORMATION RETRIEVAL SYSTEMS, April 1965
Vitro Laboratories.
VITRO DICTIONARY OF ABBREVIATIONS
*(WB)Weather Bureau.
LISTING OF TERMS
WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY, Unabridged, 1961

West and Todd.
TEXTBOOK OF BIOCHEMISTRY
*(WE)Western Electric Company.
LISTING OF TERMS
Weston Instruments, Incorporated.
GLOSSARY OF TERMS USED IN THE ELECTRICAL INDICATION INSTRUMENT INDUSTRY, Section IV
White Sands Missile Range, Range Commanders Council.
A GLOSSARY OF RANGE TECHNOLOGY
Wiley, John and Sons Incorporated.
A GLOSSARY OF GEOGRAPHICAL TERMS, 3rd Impression, 1962
Williams and Wilkins Company.
BERGEY'S MANUAL OF DETERMINATIVE BACTERIOLOGY, 7th Edition, 1957
*(YO)Youngstown Sheet and Tube Company.
LISTING OF TERMS

APPENDIX 7

(Verso Blank)

Thesaurus Rules and Conventions

Introduction

Building a thesaurus for vocabulary control in information storage and retrieval systems requires that certain decisions be made and recorded so that the thesaurus structure is internally consistent and reasonable. Moreover, users of a thesaurus need to know the rules and conventions upon which it is based for efficient and intelligent use.

These rules and conventions were used as the basic reference in the joint EJC-Project LEX development of an identical thesaurus for both Engineers Joint Council and the Department of Defense. The principles set forth should be generally applicable to thesaurus development and use. Uniform application of widely accepted thesaurus rules and conventions in information storage and retrieval systems may be expected to facilitate compatibility of systems for more efficient operation.

The thesaurus rules and conventions were prepared by a Task Group of the EJC Engineering Vocabulary Panel, Robert Dodds of Gibbs and Hill, chairman. Members of the Task Group were:

David M. Liston — Battelle Memorial Institute, chairman

Margaret Hicks — CFSTI, assigned to Project LEX

Jack W. Hilf — Bureau of Reclamation, Dept. of the Interior

Terry Gillum — DDC, assigned to Project LEX

Eugene Wall — Consultant to Project LEX

Indexing Terms—Descriptors[1]

The description of technical documents (indexing) for information storage and retrieval requires the use of two types of terms: (a) those that describe the information and data contained in the document, and (b) bibliographic terms—terms that describe the document itself, not the information in the document. Bibliographic terms, examples of which are personal authors, corporate authors, and publication dates, should not be included in the thesaurus. Terms that describe the information contained in the documents may include (1) project names, (2) military nomenclature, (3) identification symbols or numbers, (4) nicknames or jargon, (5) geopolitical names, (6) trademarks, (7) other proper names, (8) terms of an analytical nature, such as *anemometers, boundary layer, cardiovascular system, density, energy conversion, heat resistant alloys, spectroscopy;* and (9) terms of an abstract nature, such as *tests, measurement,* and *calibration*. The index terms of primary concern to the thesaurus are types 8 and 9. For convenient reference, terms selected to be entered into the thesaurus for use as indexing terms will be called "descriptors."

The rules and conventions for constructing the thesaurus are of three types: (1) those dealing with fundamental terms (T-1 to T-12); (2) those dealing with cross references (C-1 to C-8); and (3) the alphabetization rule (A-1).

T-1
Descriptor Selection

Descriptors should be selected for inclusion in the thesaurus on the basis of their estimated usefulness in communication, indexing, and retrieval. In general, utility of terms can be estimated by considering (a) the relative frequency of occurrence in the literature, (b) the relative frequency of use within an operating system, (c) relationships to descriptors that have been selected previously, and (d) scientific or technical precision and acceptability. These factors are very much interdependent and should be considered together in the selection of descriptors.

a. Frequency of prior use of a term in indexing and searching within a particular vocabulary gives a rough quantitative indication of its usefulness. The importance of frequency of use of a term depends upon the usage of other terms, the relative age of the term, and the age and scope of the collection. Terms that have been used relatively often within a given vocabulary may represent concepts that are poorly defined or too general to be useful in describing subject matter, whereas those that have been used very infrequently may represent concepts that are obscure or overly specific. Low frequency of use should not necessarily cause the rejection of a term that represents a novel concept and is a recent addition to the original vocabulary. The general rule is to establish descriptors that convey specifically the subject matter indexed. The utility of the terms can then be evaluated by reviewing their frequency of use in indexing.

[1] Examples of descriptors included in these rules and conventions are chosen for illustration only, and do not necessarily appear in the thesaurus.

b. As construction of the thesaurus progresses and descriptors are selected, an ad hoc vocabulary framework will emerge. This structure will help form a basis for the selection of additional descriptors. Candidate descriptors should be examined to determine that they reflect a level of specificity commensurate with that of the existing structure and that they represent discreet concepts. Avoid the selection of descriptors whose meanings coincide so closely with those of established descriptors that indexers (and searchers) will have difficulty in distinguishing between or among them.

c. The acceptability of terms can be determined by consulting dictionaries, encyclopedias, other indexing vocabularies, and the opinions of subject specialists. Slang, jargon, coined terms and deprecated terminology should be excluded.

d. It is usually desirable to establish a maximum term length for the purpose of maintaining succinctness of terms or for other special purposes such as maintaining the capability for a particular page format in a printed thesaurus. A maximum of 36 characters per term is recommended.

T-2
Noun Form

Use noun forms wherever possible; for example, *roughness* rather than *rough*. In a limited number of instances, needed retrieval concepts can be represented only by adjectives or equivalent expressions. These usually take the form of words or phrases that describe in some manner the operation of equipment or systems; for example, *airborne, mobile, portable*.

Never use verbs; for example, use *catalysis* rather than *catalyze*, the gerund *pouring* rather than the verb *pour*.

T-3
Singular vs. Plural

In choosing between singular and plural noun forms, a useful rule of thumb may be applied as follows: use the plural form when the proposed term is a count noun, that is, a noun which may be used to answer the question "how many?" (for example, devices such as *gages, nozzles, fuzes);* use the singular form for mass nouns, those that express "how much?" (for example, *iron, wood, charcoal);* use the singular for specific processes, properties, or conditions. Table 1 provides a summary of the recommended procedure. Common usage should be followed for term types not covered in the above general rule or in the table.

T-4
Direct Entry

Descriptors consisting of two or more words should be listed in their natural word order, that is, the order normally used in English sentences; for example, *radar antennas* rather than *antennas, radar; refractory materials* rather than *materials, refractory*.

T-5
Descriptor Definition

Terms that have more than one accepted meaning, that are intended to be used in a somewhat different way than ordinarily defined, or for which distinctions from other descriptors must be drawn, should be accompanied by an explanation. The meanings of terms can be clarified or made more specific in the following ways:

a. Modifying terms can be used to preface a given term, as in *metal tubing* to make the meaning of the term *tubing* more specific. This is the method underlying the construction of direct entries (See Rule T-4) and is subject to the limitations of the rule on multiword descriptors (See Rule T-11).

b. A parenthetical qualifying expression can be appended to a homograph to clarify its meaning; for example, *mercury (metal)* and *mercury (planet)*. Such a qualifying expression becomes a part of the descriptor.

c. Employ the "–ing" suffix for processes and the "–ion" suffix or other appropriate suffixes for materials, characteristics, etc., when necessary to distinguish clearly among them. Examples are: *concentration* and *concentrating; precipitation* and *precipitating*.

d. When a qualifying expression cannot adequately convey the intended meaning, a short explanation called a scope note should accompany the term. Precise dictionary definitions usually should not be attempted. The scope note merely indicates the way in which the descriptor should be used. It is not a part of the descriptor, but follows on a succeeding line, as:

water cooling
cooling with water

e. Since trademarks are recognized by law as being proprietary, they should be identified in the thesaurus by the qualifying expression "(trademark)." When the meaning of a trademark is not self-evident, a scope note may also be added to clarify its meaning.

T-6
Synonyms

When two candidate descriptors are true synonyms, one should be selected as the descriptor, the other entered as a USE reference. (See Rule C-2a.)

T-7
Quasi-synonyms

To prevent scattering of like information in indexing and to obviate multiple searches for effective retrieval of information, it is both practical and desirable to consider terms having certain special relationships to be synonyms for indexing and retrieval purposes, that is, quasi-synonyms.

Terms that represent different viewpoints of the same property continuum may be considered quasi-synonyms; for example, *smoothness* and *roughness*. The

TABLE 1. GUIDELINES TO SINGULAR-PLURAL USAGE

TYPE OF TERM	*USE SINGULAR FORM*	*USE PLURAL FORM*
Material terms, such as: chemical compounds mixtures materials	When term is specific, as: urea cellophane beeswax	When term is generic, as: amines solvents plastics
Terms representing properties, conditions, characteristics	When term is specific, as: viscosity temperature purity opacity	When term is generic, as: physical properties process conditions
Terms representing equipment, devices, physical objects, and elementary particles	Do not use singular	Use plural, as: pulverizers regulators mesons teeth stars
Class of use terms	Do not use singular	Use plural, as: adhesives catalysts
Process terms	Use singular, as: constructing installing modulating	Do not use plural
Proper names (A proper name is defined as the name for a *single unique* item)	Use singular, as: Hookes Law Pluto	Do not use plural
Disciplines, fields, subject areas	Use singular according to common usage, as: chemistry hydraulics engineering	Do not use plural (Words such as "hydraulics" are actually singular)
Events or occurrences	Do not use singular	Use plural, as: ambushes explosions discharges

preferred term should be entered as a descriptor, the other as a USE reference. (See Rule C-2f.)

Terms representing concepts that overlap significantly may be treated as quasi-synonyms; for example, *lighting* and *illumination; duration* and *time; genetics* and *heredity*. The preferred term should be indicated by a USE reference. (See Rule C-2e.)

T-8
Punctuation

Punctuation marks in descriptors should be restricted. Highly specific systematic names, such as some chemical names, that require elaborate punctuation should be treated specially when they fall within the scope of the thesaurus. (See Rule T-10.) Parentheses should be used to enclose qualifying expressions which are included in descriptors to prevent ambiguity. (See Rule T-5.) Commas, periods, apostrophes and most hyphens should be excluded since they are difficult to handle consistently, complicate machine processing of the thesaurus, and are not necessary to convey the meaning of the terms. Hyphens should be used only in terms whose intended meaning would be altered by omission of the hyphen. In omitting a normally occurring hyphen, the space occupied by the hyphen should be handled according to these criteria; (1) retain the space for compound adjectives, noun-noun combinations, and letter-word combinations; (2) drop the space in attaching prefixes to the base words. Examples are:

(1) high temperature testing
man machine systems
x body problem

(2) [illegible]
microanalysis
ultrahigh frequency

T-9
Abbreviated Forms

In general, abbreviated terms should be avoided as descriptors because their understanding may not be universal, their meaning may be dependent on context, or their recognition may be dependent on capitalization and periods, which are constraints in computer oper-

ations. Abbreviated terms can be used when meanings are well established and when significant gains in convenience can be demonstrated. Examples are: *ACTH* for *adrenocorticotropic hormone; PETN* for *pentaerythritol tetranitrate; VTOL aircraft* for *vertical take off and landing aircraft*. Abbreviated and unabbreviated forms of a given term should be treated as synonyms and cross referenced accordingly. (See Rule C-2c.) Well established acronyms are acceptable as descriptors; for example, *shoran, radar, maser*.

T-10
Specialized Vocabularies

Effective indexing and retrieval of information in certain specialized subject fields will require descriptor vocabularies that differ in some ways from the natural language approach of the thesaurus as a whole as in the following examples.

a. Chemistry. To avoid proliferation of terms in the field of chemistry, the names of specific chemical compounds as descriptors should be restricted. Instead, a vocabulary of descriptors representing generic compounds classes, functional groups, and structural features should be devised. This will permit indexing and searching by coordinating appropriate descriptors to denote specific compounds as well as classes of compounds.

Names of specific compounds that occur frequently in the literature may be entered as descriptors; for example, *sulfuric acid, carbon tetrachloride, morphine, progesterone*.

b. Alloys. Descriptors should be established for certain generic alloy families; for example, *aluminum copper alloys, molybdenum steels, zinc alloys*. This will permit indexing and retrieval on a somewhat general level, but will prevent proliferation of descriptors to represent specific alloy systems.

c. Biological nomenclature. Where possible, consistent use should be made of established nomenclature systems for describing plants and animals. Where departures are necessary, cross references should be provided to maintain continuity.

T-11
Multiword Descriptors

A descriptor represents a concept. In general, a descriptor should reflect the terminology found in the literature regardless of the number of words needed to express the concept. However, many candidate descriptors will represent, or appear to represent, concepts that are combinations of two or more specific descriptors or potential descriptors. In these instances, a determination must be made of the most effective way in which to incorporate the candidate descriptor, that is, by adding the specific multiword term to the thesaurus or by prescribing a combination of two or more existing descriptors.

Specific multiword descriptors often facilitate retrieval of specific information, but may add to the cost of indexing by increasing substantially the number of descriptors in the index. On the other hand, proper use of individual descriptors in indexing for later combination upon retrieval will serve to control the size of the vocabulary and to promote consistency in the use of terminology. Decisions on the formation of specific descriptors require consideration of the following factors. If reasonable doubt remains, a specific multiword descriptor should be established because, if it eventually proves to be of little utility, it can easily be reduced to a combination of individual descriptors. The converse is not easily accomplished.

a. A specific multiword descriptor should be established when suitable more general descriptors are not available in the vocabulary. To provide adequate representation of the specific concept, a combination of general descriptors must include at least one descriptor that is a member of the same hierarchical class as the specific concept. Observation of this principle will promote more consistent and complete retrieval, whereas the use of a combination in which neither descriptor bears a generic relationship to the specific concept may lessen retrieval efficiency.

b. A specific, multiword descriptor should be established when the specific concept is encountered so frequently that the ability to index and search directly would be both expeditious and economical or when one or both of the more general descriptors is so often used in indexing as to make searches awkward or inaccurate.

c. Two or more individual descriptors should be used instead of establishing a specific multiword descriptor when the specific concept is a member of the same generic class (See Rule C-4) as each of the more general descriptors.

Cross References

C-1
Cross References

Relationships among terms will be shown by cross references, which will aid users in selecting descriptors from the thesaurus. Types of cross references and their symbols that will be used as required are:

Cross References	Symbols
USE	USE
USED FOR	UF
BROADER TERM	BT
NARROWER TERM	NT
RELATED TERM	RT

These are described in the following rules.

C-2
Use

The USE reference is intended to lead users of the thesaurus to appropriate descriptors and should be employed to refer from a term that is not an authorized descriptor to the term which has been chosen as the descriptor, as follows:

a. to indicate a preferred synonym; for example, *lysozyme* USE *muramidase; secondary batteries* USE *storage batteries;*

b. to refer from a specific term to a more general term which has been selected to represent (that is, subsume) the specific concept; for example, *plant waxes* USE *waxes; sand blasting* USE *abrasive blasting;*

c. to indicate a preference between spelling variations, or to expand or explain abbreviations; for example, *pi mesons* USE *pions; inflammability* USE *flammability; pentaerythritol tetranitrate* USE *PETN; IFF* USE *identification systems;*

d. to prescribe the use of two or more descriptors to express a concept; for example, *ferromagnetic films* USE *ferromagnetic materials* and *films; antitank rockets* USE *antitank ammunition* and *rockets; optical illusions* USE *illusions* and *vision;*

e. To express concepts that can be considered synonyms for purposes of indexing and retrieval; for example, *heredity* USE *genetics; semantemes* USE *semantics;*

f. to bring together different viewpoints of a conceptual continuum; for example, *fluidity* USE *viscosity; smoothness* USE *roughness; instability* USE *stability.*

g. to explain variations in word order; for example, *tables (mathematics)* USE *mathematical tables; propellers (aerial)* USE *aerial propellers; propellers (marine)* USE *marine propellers;*

h. to reflect current terminology; for example, *electrical condensers* USE *capacitors;*

i. to eliminate jargon; for example, *whirly bird* USE *helicopters.*

C-3
Used For

The USED FOR reference (UF) is the mandatory reciprocal of the USE reference and accompanies the descriptor to which the USE reference refers. Accordingly, the USE references in two of the examples given in Rule C-2b and C-2c would generate the following USED FOR references:

abrasive blasting
UF sand blasting

pions
UF pi mesons

When a USE reference has prescribed two or more descriptors to represent a concept (See Rule C-2d), a unique symbol such as the dagger sign (†) should be placed in front of the unauthorized term in the USED FOR reference; for example, *ferromagnetic films* USE *ferromagnetic materials* and *films;*

ferromagnetic materials
UF † ferromagnetic films

films
UF † ferromagnetic films

C-4
Broader Terms

The BROADER TERM reference (BT) is employed to refer from a term representing a member of a class (or classes) of concepts to any term(s) in the thesaurus representing that class or classes; for example, *steels* BT *iron alloys.* For each BROADER TERM reference there must also be provided a corresponding NARROWER TERM reference. (See Rule C-5.) The part-whole relationship is usually not a broader-narrower relationship; for example, *gear teeth* BT *gears* is incorrect. However, in certain specific areas, part-whole generics can be usefully employed. These areas are anatomy and geographic locations. Also specifically excluded from the broader-narrower term category are relationships based on the possible applications or uses of an entity; for example, *platinum* is not considered to be a member of the generic family *catalysts* because, although it is sometimes used as a catalyst, it has too many other applications to list all as broader terms. *Platinum* is, however, always a member of the class metals, so that the reference *platinum* BT *metals* should be entered.

Wherever a descriptor for which there are narrower terms in the vocabulary appears in the thesaurus display as either a narrower term or a related term, it should be preceded by an unambiguous symbol (such as

the hyphen) to indicate that it is not the most specific concept of its class. The placement of such terms in the thesaurus should be such that the term is left justified according to its first alphabetical character (so that the alphabetical portion of the entry lines up with the terms above and below it in the display). (See also Rules C-5, C-6, and C-8.) For example in the thesaurus display:

impedance

NT	acoustic impedance
	capacitive reactance
	characteristic impedance
	– electrical impedance
	– electrical resistance
	inductive reactance
	input impedance
	– reactance
	transfer impedance
RT	bandwidth
	conductivity
	– damping
	dead time
	– dynamic response
	hold-up
	– resistivity
	transient response.

the hyphen designator shows that, for the terms so designated, there are more specific terms available in the vocabulary.

C-5
Narrower Terms

The NARROWER TERM reference (NT) is the reciprocal of the BROADER TERM reference (See Rule C-4) and is employed to refer from a term symbolizing a concept class to all terms symbolizing concepts that are members of that class; for example, *iron alloys* NT *gray iron, mottled iron, steels.* For each NARROWER TERM reference, there must be provided a corresponding BROADER TERM reference.

C-6
Hierarchy

BROADER TERM references and NARROWER TERM references are hierarchical references. If there exist more than two levels in such hierarchies, the cross references for all levels should be completed for each term. This is done to enable the thesaurus user to ascertain the appropriate level of specificity in a family of generically related concepts and to promote editorial consistency during thesaurus revision, or in cases where portions of the thesaurus are extracted as specialized indexing vocabularies.

In a few instances, terms will be so broad in meaning that their utility as indexing terms will be doubtful, yet they must be retained for use in disciplines of peripheral interest or merely as a guide to more specific terminology. Under these circumstances, list under the very broad descriptor the terms to which it is desirable to refer the thesaurus user omitting cross reference designators. Append to the broad descriptor the scope note *Use of a more specific term is recommended — consult the terms listed below.* For example, the term *materials* is of little use in indexing documents that deal with materials in any but the most general way, but in a vocabulary in which many specific materials types are represented by indexing terms, the term is a useful point at which to display certain more specific terms or related terms for further study without carrying a useless BROADER TERM reference to *materials* on each of many specific terms. No reciprocal cross references should be made from listed specific descriptors to the broad descriptor, although such records should be maintained for housekeeping purposes. (See Rule C-9.)

C-7
Hierarchy Overlap

Terms may be members of more than one hierarchy. (See Rules C-4 and C-5.) For example, consider the entries *avalanche diodes* BT *diodes* and *semiconductor devices; diodes* NT *avalanche diodes.* The term *avalanche diodes* represents a concept that is properly a member of the two different classes of concepts represented by the terms *diodes* and *semiconductor devices.*

C-8
Related Terms

The RELATED TERM references (RT) is employed as a guide from a given descriptor to other descriptors that are closely related conceptually, but not hierarchically. (See Rules C-4 to C-7.) In general, any two descriptors are cross referenced RT if it is believed that the user, when examining one descriptor, might want to be reminded of the existence of the other.

RELATED TERM references may be used to identify:

a. descriptors that are closely related in meaning or concept including those in different hierarchical structures.

b. descriptors that are near synonyms.

c. descriptors that have viewpoint interrelationships, such as a relationship based on usage; for example, *alcohols* RT *solvents,* RT *antifreezes.*

d. descriptors representing concepts bearing a part-whole relationship to each other.

C-9
Reciprocal Entries

Reciprocal entries are required in every instance of cross-referencing except as noted in Rule C-6. The three pairs of reciprocal cross references are:

USE	USED FOR
BROADER TERM	NARROWER TERM
RELATED TERM	RELATED TERM

Appendix 7

Alphabetization

A-1

Alphabetize descriptors letter-by-letter, according to the following rules:

(1) Ignore all spaces between words.

(2) Ignore all characters other than left parenthesis, numerals, and letters.

(3) File according to the sequence:

(a) left parenthesis

(b) numerals in usual order

(c) letters in usual order

A representative sequence of terms filed according to the above rules is:

mercury (metal)
mercury (planet)
mercury amalgams
mercury arc rectifiers
mercury lamps
metal finishing
metallurgy
metals
metal working.

NOTE: *Metal working* is sometimes spelled as one word, *metalworking*. In letter-by-letter alphabetization, the sequential position of *metalworking* is unaffected by the spelling selected for the authorized descriptor. Similarly, the sequential position of *metal-working* is unaffected by the use of a hyphen.

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APPENDIX 8

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LINOTRON COMPOSITION SPECIFICATIONS
THESAURUS OF TERMS SECTION

PAGE 1 Trim Size: $8\frac{1}{2}$ x 11

2 Type Page: 60 x 43 picas, centered on page.

3 Page Running Heads: 7 pt Trade Gothic Caps

Left page - First bold or bold italic entry on page in 7 pt Trade Gothic Bold caps flush left; THESAURUS OF ENGINEERING AND SCIENTIFIC TERMS in 7 pt Trade Gothic caps flush right.

Right page- Last bold or bold italic entry on page in 7 pt Trade Gothic Bold caps flush right; THESAURUS OF TERMS in 7 pt Trade Gothic Caps flush left.

(See also 21)

4 Hairline Rules: 2 pt below the bottom of the running heads in a 7 pt space separate the running heads from the body. On right-hand pages a rule 3 pt below the last entry (96th data line) in a 7 pt space separates the body from the footnote.

5 Columns: Four 10 pica columns, one pica between columns. 99 lines per column left hand page, 96 on right hand page. Ragged right margin; vertical justification for short columns.

6 Footnote: A standard footnote in 6 on 7 Trade Gothic appears on every right hand page; both lines are centered.

7 Folio: 7 pt Trade Gothic flush left or right 6 pt below last line.

(See also 22)

ENTRIES

8 Main Terms (Entry Terms): 7 on 7 Trade Gothic Bold, flush left in column; runovers indent one em, break only between words.

9 Main Terms followed by USE reference: 7 on 7 Trade Gothic Bold Italic, runovers indent one em, break only between words.

10 Four digit Category Numbers: 6 on 7 Trade Gothic separated from Main Term by one 7 pt. em space; separate multiple categories by one 6 pt. en space; runovers indent one em, break only between groups of four digits.

11 Scope Notes (Explanatory Phrase): 6 on 7 Trade Gothic Italic; indent one (6 pt.) en from left or first line, second and succeeding lines indent one additional em; break lines only between words.

12 Cross Reference Designators. (USE, UF, BT, NT, RT, and): 6 on 7 Trade Gothic Caps except and which is Trade Gothic Italic lower case; indent one (6 pt.) en from left. (See also 19)

13 Reference Marks: em dash is indented 34 units from left, dagger is indented 43 units.

14 Sub-Entries: 6 on 7 Trade Gothic indented 52 units from left; runovers indent additional one em, break lines only between words.

15 Spaces between words: 6 units.

16 Sequence of Data Types: The normal order of precedence in the sequencing of different types of entries will be: (1) Main Terms, (2) Scope Note, (3) USE's, (4) UF's, (5) BT's, (6) NT's, (7) RT's. In the event the Scope Note reading "Use of a more specific term is recommended; consult the terms listed below." appears, the order will be (1) Main Term, (2) UF's, (3) Scope Note, (4) RT's; the Cross Reference Designator RT will be suppressed under these conditions.

17 Alphabetization: The sequence of main entries within the alphabet and the sequence within sub-entry type under a term will be letter by letter according to the following rule: (1) left parenthesis, (2) numerals in usual order, (3) letters in usual order, (4) ignore all spaces and special characters.

SPECIAL CONDITIONS

18 Column Breaks: A column may not end with: (1) a bold or bold italic entry (Main Term or Main Term of USE reference); (2) the last line of a Scope Note; (3) a USE reference followed by an and, or and followed by another and. Restrictions (1) and (2) are cumulative. A short column resulting from these restrictions will be justified vertically.

19 Continuations: If an entry term is continued from a right hand page to a left hand page, a column running head consisting of that entry term will be inserted at the beginning of the first column of the new page flush left in 7 on 7 Trade Gothic Bold followed by (cont'd) in 6 on 7 Trade Gothic; no category number will follow this running head. In addition, if the first data line of the new page does not also enter a new Cross Reference Designator, the old one must be entered in its appropriate position. The last line of the page from which the continuation was made will consist of (Continued) in 6 on 7 Trade Gothic flush left. There will be no notations of continuation from left hand to right hand pages or between columns on the same page.

20 New Letter of Alphabet: 18 point Trade Gothic Bold Cap centered vertically in a 70 pt. space. New letter after 48th line in last column of a page must begin a new page; the new letter will be centered at the top of the first column in a vertical 70 pt. space.

21 First Data Page: The first data page (beginning of letter A) is a right hand page, sunk 77 pts., without running head.

22 Pagination: Serial pagination beginning with the first data page which will be page 3.

Appendix 8

LINOTRON COMPOSITION SPECIFICATIONS
PERMUTED INDEX SECTION

PAGE 1 Trim Size: 8½ x 11

2 Type Page: 60 x 43 picas, centered on page.

3 Page Running Heads: 7 pt Trade Gothic Caps

Left page - First bold or bold italic entry on page in 7 pt Trade Gothic Bold caps flush left; THESAURUS OF ENGINEERING AND SCIENTIFIC TERMS in 7 pt Trade Gothic caps flush right.

Right page- Last bold or bold italic entry on page in 7 pt Trade Gothic Bold caps flush right; PERMUTED INDEX in 7 pt Trade Gothic caps flush left.

4 Hairline Rules: A hairline rule on a 1 pt body 2 pt below the running head in a 7 pt space separates the running head from the body. On right-hand pages, a hairline rule on a 1 pt body 3 pt below the last entry (97th data line) in a 7 pt space separates the body from the footnote.

5 Columns: Four 10 pica columns, one pica between columns. 99 lines per column on left-hand pages, 97 on right-hand pages. Ragged right margin; vertical justification for short columns. (See 13)

6 Footnote: A standard footnote in 6 on 7 Trade Gothic appears on every right-hand page, centered on the page.

7 Folio: 7 pt Trade Gothic flush left or right 6 pt below the last line. (See also 17)

ENTRIES

8 Entry Terms: 7 on 7 Trade Gothic Bold except 7 on 7 Trade Gothic Bold italic if the word is also a main entry in the "Thesaurus of Terms" section. Indent one en from left of column; runovers indent additional em, break lines only between words.

9 Sub-Entries: 6 on 7 Trade Gothic indented 3 ens from left of column; runovers indent additional em, break lines only between words.

10 Reference Marks: 7 pt bullet is flush left in column when it appears on entry terms; 6 pt bullet is indented one em for sub-entries.

11 Spaces between words: 6 units.

12 Alphabetization: The sequence of main entries within the alphabet and the sequence of sub-entries under main entries will be letter-by-letter according to the following rule: (1) left parenthesis, (2) numerals in usual order, (3) letters in usual order, (4) ignore all spaces and special characters.

SPECIAL CONDITIONS

13 Column Breaks: A column may not end with an entry term (bold or bold italic entry) except where no sub-entries follow the main entry. A short column resulting from this restriction will be justified vertically.

14 Continuation: If an entry term is continued from a right-hand page to a left-hand page, a column running head consisting of that entry term will be inserted at the beginning of the first column of the new page flush left in 7 on 7 Trade Gothic Bold followed by (Cont'd) in 6 on 7 Trade Gothic. The last line of the page which the continuation was made will consist of (Continued) in 6 on 7 Trade Gothic flush left. There will be no notations of continuation from left-hand to right-hand pages or between columns on the same page.

15 New Letter of Alphabet: 18 on 21 Trade Gothic Bold Cap centered in column with a 28 pt space before and a 21 space after. New letter after the 48th line in the last column of a page must begin a new page; the new letter will be centered in the first column with a 28 pt space before and a 21 pt space after.

16 First Data Page: The first data page (beginning of letter A) is a right-hand page, sunk 77 points, without running head.

17 Pagination: Serial pagination will be continued from the preceeding section. However, there will be two pages (front and back of one leaf) of hand set material between sections which must be counted. If the last page of the preceeding section was a right-hand page, the following page (reverse of that leaf) will be blank.

LINOTRON COMPOSITION SPECIFICATIONS
SUBJECT CATEGORY INDEX SECTION

PAGE 1 Trim Size: 8½ x 11

2 Type Page: 60 x 43 picas (720 x 516 pt) centered on page.

3 Page Running Heads: 7 pt Trade Gothic

Left (even) page - First new four digit field and group number appearing on page in 7 pt Trade Gothic bold flush left. If page begins with a new field (12 on 14 bold entry - see 7 below), the running head will be the field number, e.g., 0900. THESAURUS OF ENGINEERING AND SCIENTIFIC TERMS in 7 pt Trade Gothic caps flush right.

Right (odd) page - Last field and group number appearing on page in 7 pt Trade Gothic bold flush right. SUBJECT CATEGORY INDEX in 7 pt Trade Gothic caps flush left.

(See also 14)

4 Hairline Rules: A hairline rule on a one pt body 2 pt below the running heads in a 7 pt space separates the running heads from the body.

5 Columns: Four 10 pica (120 pt) columns, one pica (12 pt) between columns. 99 lines per column, ragged right margin, vertical justification for short columns. (See 12)

6 Folio: 7 pt Trade Gothic flush left or right, 6 pt below last data line. (See also 15)

ENTRIES Definition: A "field" is one of the twenty-two major subdivisions number 0100, 0200 through 2200; a "group" is one of the subdivisions of a field like 0901, 0902, etc.

7 Fields: 12 on 14 Trade Gothic Bold beginning 28 pt after last preceeding entry. The field number (followed by two final zeros) will be centered in the column on the first line. The name of the field will appear as the next line (and succeeding lines as necessary), each line centered in the column. Sub-entries categorized under a field only, i.e. all terms categorized with two final zeros, will not be

listed. The last 12 on 14 line will be separated from the first subsequent entry by a 21 pt space.

8 Groups: 7 on 7 Trade Gothic bold 14 pt. after last preceeding entry (except where preceeding entry is a field entry - - see 7 above) flush left in column. The group number will appear first on a separate line and will be followed on the next line by the name of the group. Runovers do not indent second or succeeding lines. Groups for which there are no sub-entries will not appear.

9 Sub-entries: 6 on 7 Trade Gothic indented one (6 pt) em from left of column; runovers indent additional em.

10 Spaces Between Words: 6 units.

11 Alphabetization: Same as preceeding sections.

12 Column Breaks: A column may not end with a bold entry, either 12 on 14 (see 7 above) or 7 on 7 (see 8 above). A short column resulting from this restriction will be justified vertically.

SPECIAL CONDITIONS

13 Continuations: If a group is continued from a right hand (odd) page to a left hand (even) page, a column running head consisting of the group number in 7 on 7 Trade Gothic bold followed by (Cont'd) in 6 on 7 Trade Gothic will be inserted at the beginning of the first column of the new page.

14 First Data Page: The first data page (beginning of field 0100) will be a right hand (odd) page, sunk 77 pt. without running heads.

15 Pagination: Serial pagination will be continued from the preceeding (Permuted Index) section. An undetermined number of hand-set pages which must be counted will be inserted between these sections. This information will be available at the time of processing.

LINOTRON COMPOSITION SPECIFICATIONS
HIERARCHICAL INDEX SECTION

PAGE 1 Trim Size: 8½ x 11

2 Type Page: 60 x 43 picas (720 by 516 pt)

3 Page Running Heads: 7 pt Trade Gothic caps

Left (even) page - First bold entry in 7 pt Trade Gothic bold caps flush left: THESAURUS OF ENGINEERING AND SCIENTIFIC TERMS in 7 pt Trade Gothic caps flush right.

Right (odd) page - Last bold entry in 7 pt Trade Gothic bold caps flush right; HIERARCHICAL INDEX in 7 pt Trade Gothic caps flush left.

(See also 16)

4 Hairline Rules: A hairline rule on a one pt body 2 pt below the running heads in a 7 pt space separates the running heads from the body.

5 Columns: Three 13 2/3 pica (164 pt) columns, one pica (12 pt) between columns. 99 lines per column, ragged right margin, vertical justification for short columns. (See 13)

6 Folio: 7 pt Trade Gothic flush left or right 6 pt below last line. (See also 17)

7 Main Entries: 7 on 7 Trade Gothic bold separated from previous entry by 14 pt, flush left in column.

8 Sub-Entries: 6 on 7 Trade Gothic indented one or more ems according to their hierarchical level.

9 Leadering: Leadering in the form of one or more periods will precede each sub-entry. There will be one period for each em of indentation, centered horizontally (as nearly as possible) in the one em space.

10 Spaces between words: 6 units.

11 Runovers: Runovers are not permissable in this section and should cause processing to halt if they occur.

12 Alphabetization: Same as other sections.

SPECIAL
CONDITIONS

13 Column Breaks: A column may not end with a bold entry. A short column resulting from this restriction will be justified vertically.

14 Continuations: If a main entry is continued from a right hand (odd) page to a left hand (even) page, a column running head consisting of that main entry in 7 on 7 Trade Gothic bold followed by (Cont'd) in 6 on 7 Trade Gothic will be inserted at the beginning of the first column of the new page flush left.

15 New Letter of Alphabet: There will be no separations between letters of the alphabet in this section.

16 First Data Page: The first data page will be a right hand page sunk 77 pt without running heads.

17 Pagination: Serial pagination will be continued from the preceeding (Subject Category Index) section. Two pages (front and back of one leaf) of hand-set material which must be counted will be inserted between these sections.

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APPENDIX 9

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Appendix 9

ONR:403M:RJM:sd

4 OCT 1966

FIRST ENDORSEMENT on Project LEX Memo to DDR&E of 17 Oct 1966

From: Chief of Naval Research
To: Director of Defense, Research and Engineering

Subj: Proposed Plan for a Continuing Standardization Control Project for DOD-wide Scientific and Technical Terms

1. I concur with the recommendations of the focal point representatives.

2. It is my recommendation that upon completion of the current effort personnel temporarily loaned to the project return to their parent activities and the continuation project be transferred to the Defense Documentation Center.

3. I also recommend that DDC be made Assigned Responsible Agency for the Standard Data Elements phase of the thesaurus program. It is essential for efficient management that both the thesaurus updating and development and the Standard Data Element phase of the program be accomplished by the same group.

J. R. LEYDON

Appendix 9

DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH
WASHINGTON, D. C. 20360

IN REPLY REFER TO

17 October 1966

Project LEX

MEMORANDUM FOR DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING

Via: Chief of Naval Research

Subj: Proposed Plan for a Continuing Standardization Control Project for DoD-Wide Scientific and Technical Terms

Ref: (a) DDR&E Multiple Address Memo, subj: DoD-Wide Technical Thesaurus, dtd Oct 12, 1965

Encl: (1) Proposed Plan, subject as above

1. Reference (a) established a short term project in the Office of Naval Research to prepare a DoD-Wide Technical Thesaurus. In so doing, it provided for focal point representatives from the several Services and Agencies with responsibilities that included continuation of a vocabulary control program.

2. Accordingly, the undersigned focal point representatives for the current thesaurus project (Project LEX) submit Enclosure (1) as a plan for a continuing program. Approval and implementation is recommended.

Parmely C. Daniels
Department of the Army

Lt. Colonel Davis Potter
Defense Intelligence Agency

Agnes E. Oberwortmann
National Security Agency

Robert R. Hays
Department of the Navy

Major Clayton L. Schlemm
Department of the Air Force

Lt. Colonel John E. Preston
Defense Atomic Support Agency

Mildred L. Bailey
OASD(Comptroller)

Paul H. Klingbiel
Defense Documentation Center

Concurrence:

J. Heston Heald
Director, Project LEX

Proposed Plan for a Continuing Thesaurus and Standardization Control Project for DoD-Wide Scientific and Technical Terms

I. References

(a) DDR&E Multiple Address Memorandum Subj: DoD-Wide Technical Thesaurus, dtd Oct 12, 1965
(b) ASD (Comp) Memorandum to SECNAV dtd 2 Dec 1965
(c) ASD (I&L) Memorandum to ASN (I&L) dtd 24 Nov 1965

II. Problem

A need will continue to exist, after the termination of Project LEX, for thesaurus-like control and maintenance of changes in the DoD scientific and technical vocabulary and in the establishment of the terminology as standard data elements. A decision on this matter prior to the termination of Project LEX is important to avoid a lapse in the continually changing and growing terminology and the costly task of backlog treatment at a later date.

III. Background

The first sentence in Reference (a) is cited here as the primary authority for the requirement set forth in the problem above:

> "There is a strong and continuing need in the Department of Defense for maintaining a comprehensive and up-to-date authority for the terms used to describe scientific and technical subjects."

Pursuant to Reference (a), Project LEX was established within the Office of Naval Research on a short term basis for the one-time purpose of preparing a DoD-Wide Technical Thesaurus. Reference (a) set forth a schedule to start the work in December 1965 and terminate the Project with preparation of final manuscript copy in March 1967. As of September 1966 the Project was running very close to the schedule and essentially no slippage in the manuscript copy date appeared likely. A cut-off date for acceptance of new terminology was set for November 1, 1966. Preliminary plans for printing were begun in July 1966 since the printing method and format will govern preparation of the manuscript copy.

III. Background - Continued

Reference (c) named the Navy as the Assigned Responsible Agency (ARA) with the Office of Naval Research as the action office for establishing the Thesaurus terminology as standard data elements. Reference (b) officially recognized the Thesaurus project as standardization Project MISC-0359.

IV. Discussion of Problem

It is estimated that the Thesaurus, when completed, will contain approximately 25,000 descriptors (main terms). Each will be a candidate standard data element. These descriptors will have been established through both intellectual and computer treatment that will have been given to a massive reservoir of data collected by Project LEX. The data include over 148,000 separate scientific and technical terms with all their hierarchical structuring, cross-references, scope notes, frequencies of use, and other information that was supplied by the contributors. It will be extremely important that this data bank be continually maintained as the basic tool for any continuing effort.

New scientific and technical concepts and changes in old ones are continually being generated. This causes changes in the technical vocabulary. Establishment of approximately 1200 new descriptors or changes to old descriptors are required per year to keep pace. Hence, there is a need for a continuing effort in maintaining standardized and thesaurus-like controls. Project LEX will terminate with preparation of the manuscript copy, thus control of the changing terminology will actually stop on 1 November 1966, the cut-off date for additional terms. It is important that any continuation effort be ready to assume responsibility on that date or very shortly thereafter. A substantial lapse could well necessitate another major task whereas continuation with little or no loss of time would require considerably reduced resources.

A closely related problem is the establishment of terms in the Thesaurus as standard data elements. Time will not permit completion of this work prior to termination of Project LEX as it is now constituted. Although a part of the work will have been accomplished in the Thesaurus effort, preparation of definitions and coordination with pertinent DoD offices will still be necessary. This part of the work alone (for 25,000 descriptors) is estimated to require 10 man/years.

IV. Discussion of Problem - Continued

Consideration should also be given to improved methods of vocabulary control usage and presentation. Of immediate interest is the possibility of developing graphic displays of descriptor networks showing relationships or associations. This area has much promise but requires further study as well as experimental tests with live or working situations. A continuing activity with all data at hand would be in favorable position to pursue such studies.

Reference (a) further indicated a need for a continuing vocabulary effort and provided some guidance as follows:

> "Although the project will be considered as terminated with completion of the first edition manuscript and other products that have been listed in Enclosure 1, the focal point representatives should continue to be recognized by each Service and Agency for continuation on a limited basis for further collection, refinement, and building of vocabulary terms which will eventually lead to future revisions."

From this and other discussion above, the need for a central or clearinghouse type of activity for collection, coordination, control, continuity, and operational functions becomes apparent.

A decided advantage to a continuing effort would be the fact that supplement lists or a complete thesaurus revision could be run at any given time without the necessity of regrouping and treating all terminology as Project LEX was forced to do.

V. Conclusions

1. It is believed that if the focal points are to continue to function that a central or clearinghouse point of operations be recognized with high level OSD authorization.

2. To be fully effective, it is essential that the central activity should maintain, and add to, the data bank accumulated by Project LEX and retain such key personnel as may be needed and are available. Loss of either would have retarding and costly effects on the follow-on effort.

3. Responsibility for maintaining thesaurus control and for establishing standard data elements should be kept operationally together since a large amount of the work is common to both functions.

V. Conclusions - Continued

4. The following functions are considered to be required of a continuing activity:

a. Receive scientific and technical terms from any DoD activity when new terms or changed terms are recommended as candidates for establishment as authorized descriptors.

b. In coordination with pertinent DoD activities, establish candidate terms as authorized thesaurus descriptors.

c. Notify submitting activity of actions taken on a timely basis.

d. Notify Thesaurus holders, or those on an established distribution list, of changes by issuing up-dated lists at appropriate intervals.

e. Issue revised Thesaurus on 4-year intervals as a minimum.

f. Establish descriptors as standard data elements. (This function would be separated if the activity does not remain under ONR.)

g. Maintain continued computer controls of the terminology to provide codes, programs, tapes, and special print-outs as may be needed.

h. Conduct studies in vocabulary building, utilization and graphic presentation, leading toward improved methods.

i. Work closely with COSATI in conformance with government-wide vocabulary standards and participate in development and use of such standards where applicable.

j. As required, up-date, or revise, the DoD Manual for Building a Technical Thesaurus and advise DoD activities in its implementation.

5. The present mechanism for the focal points should be continued.

V. Conclusions - Continued

6. Resources required to carry on the continuous task are estimated as follows: (These estimates are based on the experience of Project LEX).

Personnel	No.	Approx. Costs P.A.
Director	1	
Administrative Assistant	1	
Secretary	1	
Lexicographers	4	
Clerk	1	
Total	*8	$110,000
Administrative		
Supplies, phone, travel, etc.		14,000
Publications (Includes pro-rated cost of 4-year revision)		11,000
ADPS Support (Contract or In-house)		60,000
Total		$195,000

* It is estimated that this staff could establish the descriptors in the present Thesaurus as standard data elements over a period of four years and at the same time maintain continuing control of new terminology. Some reduction in staff should be possible after four years. The amount should be subject to experience.

VI. Recommendation

On the basis of the conclusions reached above, it is recommended that:

1. A continuing in-house project be recognized by DDR&E as the authority activity for a thesaurus-like control of scientific and technical terminology within the Department of Defense and that this recognition be made prior to the termination of Project LEX.

VI. Recommendation - Continued

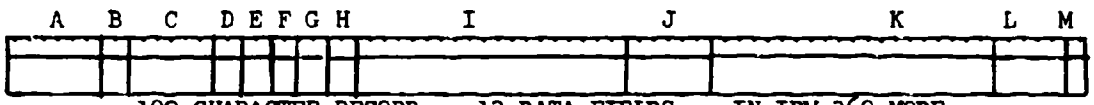
2. Personnel billets and line item funding be provided the authorized activity as a DDR&E program on a continuing basis in such a way that separate allocations from the respective Departments and Agencies will not be necessary.

3. A DoD Directive, or Instruction, be issued establishing the DoD Technical Thesaurus as an authoritative document and establishing the continuing effort as the clearinghouse or control point for scientific and technical terminology within the Department of Defense. (This action should follow 1 and 2 above, but not later than appearance of the first edition.)

APPENDIX 10

(Verso Blank)

DESCRIPTION OF LEX MAGNETIC TAPE LAYOUT



109-CHARACTER RECORD -- 13 DATA FIELDS -- IN IBM 360 MODE

FIELD CONTENT

FIELD	POSITIONS(S)	CONTENT
A	1-7	Reserved
B	8	Term relationship code; see code key below
C	9	Reserved
D	15	Line sequence code for scope note; type of pseudo scope note; see code key below.
E	16-19	Reserved
F	20-21	Reserved
G	22-23	Reserved
H	24	Reserved for term tag
I	25-60	36-character term entry, scope note line, or subject category codes; this field is also referred to as the sub-term field; see key below.
J	61-66	Reserved; used for carrying numeric surrogate of sub-term in Field I (25-60) or for extending capacity of sub-term field from 36 to 42 characters.
K	67-102	36-character term entry; this field also referred to as main-term field.
L	103-108	Reserved; used for carrying numeric surrogate of main term in Field K (67-102) or for extending capacity of main-term field from 36 to 42 characters.
M	109	Reserved; used for record indicator when required for computer configurations other than IBM 360.

"Reserved": Unless otherwise specified, the content of reserved fields varies x with the application.

Appendix 10

TERM RELATIONSHIP CODE KEY

	Type of Record Identified by Code in Fields B and D
Field B Content 1	"Main term" record (MT)
Field B Content 2	True or pseudo-scope note (SN), depending on content of Field D
Field B Content 2 and Field D Content C	Subject category record (a form of pseudo-scope note); other types can be devised as needed, using other alpha codes in Field D; subject categories are carried in 4-digit sets, beginning in position 25, with a space between sets; if more than 7 sets are needed, begin with a new record.
Field B Content 2 and Field D Content 1	First line of true scope note
Field B Content 2 and Field D Content 2	Second line of true scope note, etc.
Field B Content 3	"USE" cross reference
Field B Content 4	"Used for" (UF) cross reference (reciprocal of USE)
Field B Content 5	"Broader term" (BT) cross reference
Field B Content 6	"Narrower term" (NT) cross reference
Field B Content 7	"Related term" (RT) cross reference

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified

1. ORIGINATING ACTIVITY (Corporate author)	2a. REPORT SECURITY CLASSIFICATION
Project LEX Office of Naval Research	Unclassified 2b. GROUP

3. REPORT TITLE

The Making of TEST - Thesaurus of Engineering and Scientific Terms.

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Final Report October 1965 - November 1967

5. AUTHOR(S) (First name, middle initial, last name)

J. Heston Heald

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
November 1967	174	617

8a. CONTRACT OR GRANT NO	9a. ORIGINATOR'S REPORT NUMBER(S)
b. PROJECT NO. MISC-0359	ONR-
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	AD 661 001

10. DISTRIBUTION STATEMENT

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11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	Office of Naval Research

13. ABSTRACT

The background, operational, and procedural events leading to and including in the building of the Thesaurus of Engineering and Scientific Terms are discussed. The work was performed by the Office of Naval Research, at the request of the Director, Defense Research and Engineering, under a specially established task named Project LEX. Joint working arrangements with Engineers Joint Council resulted in a single Thesaurus for both DoD and EJC. Some resulting facts and figures are reported including recommendations to the Committee on Scientific and Technical Information (COSATI) for changes in the COSATI Subject Category List. Appendixes include authorizing papers, agreements, reference material, participants, and joint EJC-DoD conventions for thesaurus building. Results show collection and development of a large data tank, size, and description of the final product as well as computer support and interface to automatic typesetting equipment.

DD FORM 1 NOV 65 1473 (PAGE 1)

S/N 0101-807-6801

UNCLASSIFIED
Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Project LEX Information retrieval Thesauri Information sciences Summarizing Subject index terms Terminology						